The
Electrical Review

VOL. CXXIII NOVEMBER 11, 1938. No. 3181

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY. Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Waterloo 3333 (50 lines).

The "Electrical Review" is the recognised medium of the electrical trades and has by far the largest circulation of any electrical industrial paper in Great Britain. SUBSCRIPTION RATES, Postage free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Classified Advertisements—Supp. 29.
Index to Advertisers—Page xl.

Guarding Against Accidents

A valuable report

IN drawing conclusions from figures relating to electrical mishaps with a view to their future avoidance, one is handicapped by the smallness of their total and the consequent fluctuations from year to year in individual contributory causes. Indeed, they represent so small a proportion of the aggregate of accidents in industry of all kinds as to be, statistically speaking, negligible. Nevertheless, the position is not as it ought to be since, taken over the last few years, the number of electrical accidents has tended to increase with the consumption of electricity in industry. This is all the more remarkable as five years ago the figures were well below the average for each of the previous five-year periods, while to-day in the mines they show a disposition to remain stationary.

High-voltage Switchgear

With certain kinds of work, in which electricity has rapidly extended its sphere, more accidents, partly due to inexperience, are to be anticipated. In welding and in the ignition of inflammable vapour, for example, we find a considerable increase since 1932. High-voltage switchgear, in view of the increasing short-circuit power available, might also have been expected to have worsened its position. It has not done so, strangely enough: the number of accidents under this heading has remained at much the same figure and therefore forms an appreciably smaller proportion of the total than formerly. Some credit for this must be given to those supply undertakings which have derated old switchgear where necessary and have also limited the fault input to power consumers to 100,000 or 150,000 kVA. A major portion, however, must be attributed to the greater knowledge of arc phenomena obtained in recent years at high-voltage testing stations.

The importance of this improvement in switchgear performance lies not only in the relatively large proportion of fatalities this type of accident involves but also in the unfortunate results of any lack of confidence in his controlling gear on the part of the operator. Circuit-breaker explosions may have effects not unlke those of an air-raid, and if A.R.P. results in drastic alteration to some of the present methods of segregating switchgear it will be very much to the good.

It is harder to explain the great increase in the number of accidents associated with switchgear at less than 650 V. The use of metal tools on live equipment is no doubt responsible for many of these, but so it always has been. Injuries in this class are usually due to burns, and fatalities are infrequent. Fusegear is also responsible for a mounting number of accidents (in spite of improved designs), which seems to show that the value of grading circuit protection in relation to short-circuit energy is not yet fully realised.

Building construction is responsible for many items in the long list of accidents that are due to damaged cables and flexibles as well as for those due to shocks from portable apparatus. The scheme adopted by one undertaking of hiring 100-V transformers to builders is worthy of emulation.

Data upon which the above comments are based are to be found in "Electrical Accidents and Their Causes," the report which the Senior Electrical Inspector of Factories, Mr. H. W. Swann, compiles each year, the most recent of which, relating to 1937, is reviewed in this issue. This publication covers a much wider field than its modest title might convey, as its scope is not confined to analyses of accidents. It offers constructive criticism of present practice and as it also deals with means of preventing damage to large plant that have been discussed with the electrical industry, it provides many pointers to possible modifications in established methods.

Looking Ahead

Some of the most interesting of the suggestions look ahead to potential causes of trouble. A good example of this is the investigation into the effect of the escape of cooling water from a fractured inductor coil into a break in the lining of a high-frequency furnace. So far the few cases that have occurred have done little harm, but the danger might assume more serious dimensions with the development anticipated.

One of the objects of issuing the electrical section separately from the main Factory Report is that engineers, foremen and other workers may become acquainted with the circumstances that have led to accidents so that they may avoid them. It should, therefore, be studied by all ranks. The proportion of unskilled persons involved in accidents increases year by year, but ignorance is not alone responsible. It is up to the designer to make it impossible for skilled and experienced men to be the victims of their own absent-mindedness.

The Balloon Barrage

Two mishaps which occurred during the first trial of the London balloon barrage on October 8th have raised questions as to the possibilities of trouble as the result of the balloons being brought down during a raid. In one case a trailing cable "shorted" a third rail on the Southern Railway and in the other some 132-kV lines in Essex were fouled, causing a brief stoppage of supply to certain districts. Inquiries addressed to the authorities have brought us an assurance that there is little risk of damage from this cause. The breakaways which occurred during the trial are said to have been due to a small technical defect and steps have been taken to remedy this.

Restore Public Confidence

FIRST thoughts of the news of the Birmingham breakdown last Friday evening are naturally about the amount of good work by E.D.A. that it has undone. Consumers will want to be reassured as quickly as possible that there will be no recurrence, as far as human skill can prevent it. This point is evidently appreciated by Sir Percival Bower (himself a former chairman of E.D.A.), who has promised to make a full statement on the matter to the City Council. In this, allocation of responsibility is of small moment compared with the need to do all that may be necessary to avoid a repetition not only at Birmingham but also at any other places where a combination of circumstances might yield similar results.

Making the Best of It

THE technical causes of the shut down at Birmingham are dealt with in a statement issued jointly by the Corporation and the Central Electricity Board. From the particulars we give on a later page, this appears to have been another case of a combination of circumstances which make the theory of probability seem baseless and which from time to time confound the best-laid schemes of electricity supply engineers. Certain precautions have been decided upon and the reasons for the instability of the Hams Hall auxiliaries are to be investigated. The results of this inquiry should be of wide interest, as practice in this respect is by no means standard. Another matter having more than a local bearing that would form a profitable subject for inquiry is the length of time taken to complete switching operations when restoring supplies to a large network. Everything is to be gained, as in the Bradford case, by giving full publicity to such investigations, thus extracting benefits from mishaps.

Settlement at Eastbourne

THE differences between the Eastbourne Electricity Department and the local contractors have now been settled. It will be recalled that the Department proposed to discontinue the arrangement by which contractors were credited with 25 per cent. discount when sales were made at the Corporation showrooms. For their part the contractors suggested that the Corporation should cease selling articles, confining its attentions to display and demonstration. The latest development is a set of proposals by the contractors that they should receive the full trade discount when direct sales result from introductions by them; 15 per cent. when hire-purchase sales are made; and 10 per cent. when sales are made to customers not introduced by a contractor. The Electricity Committee recommended the acceptance of part of the proposals but the Town Council adopted an amendment accepting them in their entirety. We hope that henceforth these two complementary branches of the industry in Eastbourne will dwell together in unity.

Treatment of Shock

A LINESMAN employed by a large power company was killed a few days ago while working on an 11-kV overhead line. It is stated in the daily Press that artificial respiration was tried in vain for over an hour, but presumably in this case there was other evidence of death than failure to revive within that period. Our object in drawing attention to it is that the mention of "over an hour" might be taken by the inexperienced to mean that lack of success in an attempt at resuscitation that lasted for as long as this is of itself an indication that life is extinct, whereas recovery has often taken several hours to bring about. In "Electrical Accidents" the necessity for general knowledge of first-aid treatment of electric shock is emphasised with special reference to the successful outcome of prompt action in twelve cases last year in which men who had been rendered unconscious were restored.

No Mention

THE King's Speech to Parliament on Tuesday contained no specific reference to any measure for dealing with electricity distribution and the Prime Minister did not reply to a passing inquiry made by Mr. Attlee, the Leader of the Opposition. As we said last week, the state of affairs in general compels the Government to deal only with absolutely essential matters, and although reorganisation may be most desirable it can hardly be said to be vital.

Compulsory Rules

A NATIONAL Committee on Statutory Wiring Regulations and Registration was set up earlier in the year, largely as the result of a report prepared by a committee of the Association of Supervising Electrical Engineers. The Committee has so far held three meetings at which the activities of two sub-committees were considered. One of these has redrafted an enabling clause which has been submitted to the Minister of Transport for inclusion in any forthcoming Electricity Bill. The other sub-committee has been responsible for a "statement of evidence" to show the necessity for the scheme which the Committee as a whole has drafted. Most of the principal bodies concerned are represented on the Committee whose chairman is Mr. S. B. Donkin, past president of the Institution of Civil Engineers.

Glare and Light Eyes

AGE is related to the number of foot-candles required for comfortable reading, as those who have undergone the test at the Lighting Service Bureau sadly realise. Sensitivity to glare also increases with every birthday, but it also depends, according to *Science*, on whether the viewer has light or dark eyes, irrespective of their colour. Light-eyed persons of, say, thirty years of age, have the same average susceptibility as those with dark eyes in their early forties and are under a double handicap when driving a car at night. They see the road less clearly when confronted by glaring head-lamps and when these are not troubling them they are unable to distinguish dim objects so readily, the reason being that their eyes are relatively insensitive under the lower values of illumination.

IN THIS ISSUE

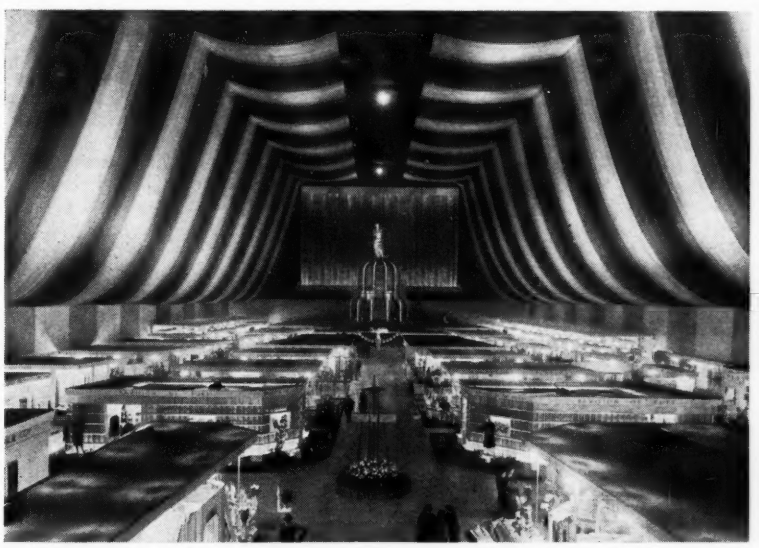
Articles:	*Page*
High-voltage Lines and G.P.O. Circuits ..	*678*
Luminous Flux	*679*
Photographic Illumination	*681*
Small Heating Installations	*682*
Manufacturers and Wholesalers	*692*
News:	
Woman's Fair	*675*
Here and There	*680*
Electricity in Factories ..	*683*
Small Motor Manufacture	*691*
Electricity in Ships ..	*691*

Electricity in the Home

A review of the exhibits at the Woman's Fair, Olympia

THE "Woman's Fair" is a rather misleading title for the exhibition which until November 26th is being held at Olympia, London. One inevitably associates it primarily with clothes, cosmetics, perfumery, hairdressing and the like, whereas in point of fact these things play only a comparatively insignificant part in the display. Actually the Electrical Section is without question the most prominent feature of an exhibition which covers almost every aspect of home life.

Surmounted by a 14-ft. statue of Venus "bathing" in a 60-ft. fountain of light, it covers 23,000 sq. ft. of floor area and is the natural focus of attention in the Main Hall. The scheme includes a central display arranged jointly by the British Electrical Development Association and the London Electricity Supply Association, with individual exhibits of some twenty manufacturers grouped around. In addition to these, various other electrical manufacturers have taken stands in other sections.



A general view of the Woman's Fair looking towards the Electrical Section

On the front of the E.D.A. Pavilion a large-scale representation of a hand with switch knobs around it indicate that "Everything is at your finger tips." Leading up to this is a wide gangway on each side of which can be seen a selection of modern equipment in illuminated recesses over which are such appropriate greetings as "Your obedient servant," "Warmest greetings," "Yours to command," etc.

In the centre of the display is a large circular information bureau which is indirectly illuminated by lamps concealed at the top of the central pillar. Symbolic decoration of the side walls in the form of large playing cards point out how economy, freedom and beauty are brought by electric lighting, heating and power, the uses and advantages of which, for women in particular, are fully demonstrated in the four adjoining sections of the pavilion.

Under the heading "Home Life" the forms of interior lighting are displayed, while a series of tableaux with the theme: "The good old days—but electricity has its points" furnishes invaluable ideas for fully electrifying every part of the house—living-room, dining-room, nursery, bedroom, kitchen and bathroom. At least three plug points in every room is the ideal aimed at. Large mural pictures draw attention to the "Better Light—Better Sight" campaign, other advantages of electricity are brought home by amusing marionette shows.

This striking design is incorporated in the front of the E.D.A. Pavilion

Electrical aids to beauty and health form another part of the exhibit, and separate little sections are devoted to artificial sunlight, curative and beauty treatment apparatus. Women are reminded that "Electricity lengthens your line of life" and also that electricity gives more time for leisure and sport. Posters detail the various services which a unit of electricity will perform.

On the outer side walls of the Pavilion are two ingenious devices constructed of neon tubing. One shows how the water heating is carried out in the home, while the other demonstrates how heat is converted into electricity. The distribution of electricity in the London area from the four main power stations at Fulham, Battersea, Bankside and Barking is shown by means of a pictorial map. A sound film describing the operation of the Barking power station is to be seen in a cinema in the gallery.

In addition to being responsible for the organisation of the complete electrical section, E.D.A. has arranged a series of electric cooking demonstrations in conjunction with the Electrical Association for Women and various exhibitors, including the General Electric Co., Ltd., Rubery Owen & Co., Ltd., Belling & Co., Ltd., the English Electric Co., Ltd., the Hotpoint Electrical Appliance Co., Ltd., Moffats, Ltd., and the Jackson Electric Stove Co., Ltd. These are held thrice daily, in a special demonstration theatre in the Grand Hall Gallery.

What is described as the most up-to-date kitchen in the world for cleanliness and labour-saving ever shown to the public is to be found in the "Mother and Her Children" section. It is sponsored by the Health and Cleanliness Council and has been designed by the Kitchen Planning Centre. All-electric, of course, it contains a sink of stainless steel with draining boards on both sides; a streamlined cooker; ample cupboard space; a compact washer which fits under the draining board; a drying cupboard; washable walls; and lighting arranged to ensure that there are no dark corners and that, at both sink and cooker, full benefit is derived from it.

Another interesting electrical feature of the exhibition is "The Mother's House," which shows the ideal maternity clinic of the future. It is equipped with an ultra-modern consulting room with shadowless lighting for the examination of patients, an electric incubator, electric blankets, etc.

Before we pass on to describe the individual displays of the electrical manufacturers a few words regarding the illumination scheme of the exhibition will probably be of interest. Constantly changing colour lighting illuminates the statue of Venus already mentioned and also the 42-ft. high colonnade beneath. Incidentally the statue, which weighs 2 tons, is the largest structure ever erected in Olympia. The impression of water flowing from the top of the colonnade is created by illuminated troughs, the insides of which have been treated with aluminium. For these two thousand pigmy lamps in coloured aluminium reflectors have been employed. To make the rainbow-like canopy over Venus 2,900 ft. of fabric 63 ft. wide were required.

The background to the statue is an illuminated curtain, measuring 90 ft. by 60 ft.—said to be the largest ever made. It consists of 2,000 yds. of silver satin material arranged in festoons and it needs 400 150-W lamps to illuminate it, the colour changing cycle taking four hours. For the colonnade

and curtain alone no less than 5 miles of cable have been employed, while about 100 miles have been needed for the whole exhibition. Through a window in the side of the E.D.A. Pavilion visitors are able to see the neat switchroom from which these special lighting features are automatically controlled, "porthole"-lights indicating the various phases of the colour lighting. The switchboard has been faced in aluminium.

Aluminium is in fact perhaps the most important "ingredient" of the lighting scheme and is employed extensively not only for the special features but also for the semi-indirect lighting units which have been standardised for illuminating the individual stands. Architectural, Constructional and Electrical Utilities, Ltd., who were responsible for the lighting arrangements throughout the exhibition, are indeed pioneers in the use of the metal in decorative and lighting schemes and on the company's own stand may be seen further examples of modern applications.

One of the most impressive is an illuminated sculptured alcove of specially treated fibrous plaster in which fluorescent lighting effects have been introduced. The use of an aluminium alloy with a thin coating of pure aluminium is the secret of the construction of a new range of industrial lighting units, a dispersive model of which has the high spacing ratio of 2½ : 1.

Tradesmen, such as butchers, provision merchants, florists, etc., are finding the same company's coloured aluminium reflectors of great advantage for displaying their goods, while there appears to be a considerable market, both for commercial and domestic purposes, for a lighting unit which provides normal indirect illumination from the top with ultra-violet radiation from the bottom for producing fluorescent lighting effects on flowers, etc., placed beneath. The u.v. rays are restricted to a concentrated beam so as to prevent any risk of harm to eyesight.

The attractive displays arranged by the General Electric Co., Ltd., and the English Electric Co., Ltd., with (above) a portion of the composite refrigerator exhibit organised by E.D.A.

The largest stand occupied by any individual electrical manufacturer has been arranged by the General Electric Co., Ltd., its attractive open design permitting a most comprehensive display of products without overcrowding. Cooking demonstrations are given five times a day in a model kitchen accommodating about thirty people and special attention is being drawn to the new streamlined cooker described on page 690 of this issue.

The ability of electrical equipment to blend with any decorative scheme is exemplified by the display of G.E.C. lighting equipment and fires, while the use of "Osira" fluorescent tubes for decorative purposes is demonstrated to good advantage by incorporating them in the general illumination scheme of the stand. The new touch opening is to be seen on the latest Coldair refrigerators, which are more streamlined than their predecessors and have a larger ice-making capacity. As a separate exhibit a television theatre has been equipped throughout with G.E.C. apparatus, the attractions of this latest form of entertainment being emphasised by numerous large photographs over which appear the words "In one week you could have seen . . . ."

A film entitled "A Turning Point in Modern Cookery," demonstrating the "Ritemp" automatic oven control is shown at cooking demonstrations given on the English Electric Co.'s stand where typical examples of the company's cookers, fires, water heaters, washing machines and other domestic appliances are to be seen. In addition to the new "Super Reflector," screen, illuminated panel and convector fires shown, there are still later additions in the form of units constructed of armour-plate glass, which has the element sprayed on it and itself acts as the radiating surface. The colour range of the cookers has recently been extended to include green and cream, and two-tone ivory.

A cabinet type washing machine, a table-top ironer and an automatic streamlined iron are new products to be found on the Hotpoint stand. The washer, which is slightly cheaper than its predecessors, is completely streamlined and when not in use fits under the draining board. It has a cupboard in the base to accommodate the wringer. Each half of the ironer is separately thermostatically controlled, while a feature of the new iron is an ingenious swivelling flex device.

As well as being displayed in a special laundry section of the stand, these new appliances are demonstrated in their appropriate setting in a model all-electric kitchen, the equipment of which also includes a cooker, dish-washing machine and a "Disposall" sink unit. Also represented in the Hotpoint exhibit is a complete range of standard cookers, breakfast cookers, snack-bar grillers, vacuum cleaners and circulator type immersion water heaters.

Another new washing machine which can be put under the draining board, or even under the table, is seen on the Hurley stand. The "Foldaway," as it is called, has telescopic legs enabling it to be stowed away in a space 9 in. by 12 in. and also to be adjusted so that its table top may be utilised for ironing purposes. A compartment is provided inside for holding the wringer.

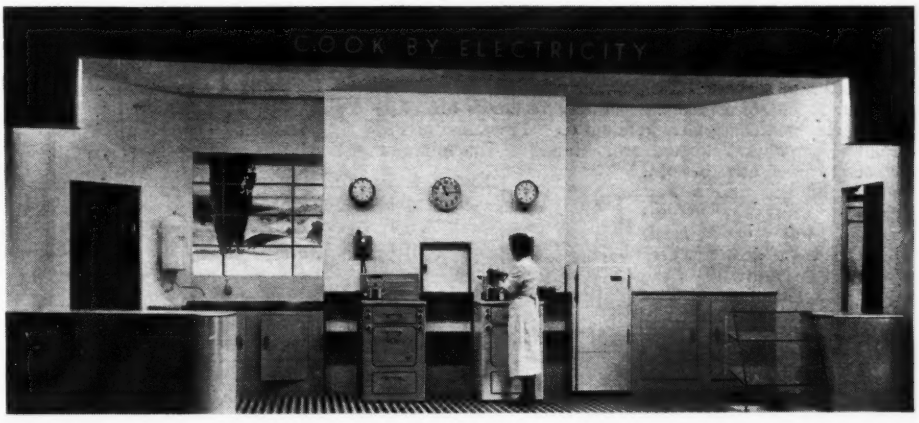
The entry of E. K. Cole, Ltd., to the domestic laundry equipment market is indicated by the display of Ekco-Coffield washers, which include cabinet and *de luxe* models with double wall construction with special bowl-bottom tubs. The highest priced model has a self-timing switch. The company's "Thermovent" convector exhibits include both inset and portable types, with built-in thermostatic control, luminous effect and fresh air ventilators as special features.

Ismay Distributors have, in addition to a complete range of the 1939 "Sterling" electric clocks, a number of new "Connor" washers. Among these the "Thermo" models have lagged tubs, improved wringer pressure releases, balloon rollers, and concealed pumps. Other types of home laundry equipment are shown by Servis Electric Washers, Barker & Turner, Beatty Bros. and Apex-Vactric, who also display vacuum cleaners and refrigerators.

Two stands are occupied by the British Vacuum Cleaner & Engineering Co. On one is seen washing machines, including the latest low-priced "Popular" model, while the other is devoted to improved types of "Goblin" cleaners and clocks. The "Goblin Cabaret" is playing to full capacity thrice daily on the orchestra stage in the Empire Hall. Vacuum cleaners

are represented elsewhere by C.C.A., New Welbeck and A.C. Cossor, the last-named company also having clocks and radio apparatus on view.

The "Backer-Jackson" radiant hotplate and the "201" streamlined cooker with a radiator incorporated in the base are attracting special interest on the Jackson stand. Among home laundry equipment a new sink model washboiler has an outer white enamel lid which forms a draining board, and to demonstrate the operation of the thermostatic control an empty boiler is left continuously on circuit. Coloured cookers are being displayed while a series of small panels houses a complete range of fires.



The well-equipped all-electric kitchen in the theatre on the Grand Hall Gallery where cooking demonstrations are given thrice daily
[Elec. Rev. photo.

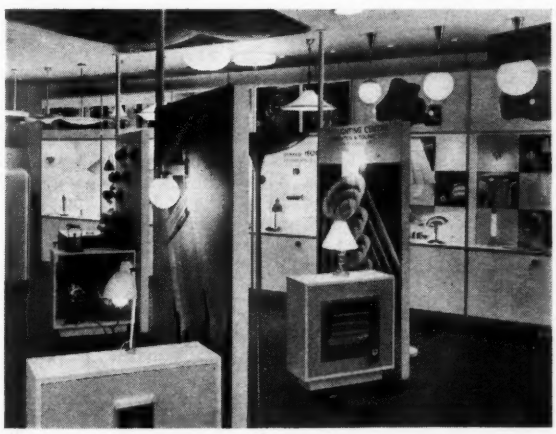
The new "Lumera" fires with their warm orange glow from ornamental scrolls figure prominently in the Ferranti exhibit which also includes water heating apparatus and clocks of various modern designs. Among new fires shown by Belling & Co., are models with the realistic "Formalite" imitation coal effect and also convectors. Cooking demonstrations are given on apparatus which includes the latest streamlined thermostatically controlled cookers such as are used in the Royal Nurseries at Sandringham.

Many pleasing colour finishes are available on the Moffat cookers and refrigerators, while the cylindrical oven with its rapid and even-heating qualities is the outstanding feature of the somewhat revolutionary design adopted for the "White Knight" cooker shown by Rubery Owen. Stokes Appliances demonstrate their well-known table cooker, and the latest "Chef" automatic cookers and refrigerators are on view on the Orme Evans stand.

To enable the housewife to go out all day and come home in the evening to find a meal all ready for serving, the Horstmann Gear Co. introduces the "H.B.E." time switch which automatically switches the cooker on and off at predetermined times. The device has many other possible uses both in the home and in industry.

Special utensils for hotplate cooking are shown by both Corfield-Sigg, Ltd., and Hague & McKenzie, Ltd. The latter company's exhibits also include the new thermostatically controlled "Swift" kettle, porringers, steam cookers, coffee urns with safety cut-out and two-heat control, coffee percolators, an oval warming plate and the "Pyramid" iron with two-heat control. An extra quick boiling kettle and a coffee percolator with a compartment for heating milk are the latest additions to the Bulpitt & Sons' products.

The new "Niagara" electrically driven and heated dish-washing machine produced by Smith's (Dishwashers), Ltd., appears on the Tepalin stand. Eight dozen articles can be dealt with at once, two parallel jets of water striking them front and back. A 1,800-W element serves the dual purpose of heating the water in the sump if necessary and of providing hot air for drying. A composite refrigeration display has been arranged by E.D.A. showing models made by H.M.V., Kelvinator, B.T.H., Alba Crosley, Stern and Frigidaire.



[Elec. Rev. photo.
A special electrical exhibit in the Design Section of the Fair

Free advice on lighting problems is given automatically on the E.L.M.A. stand by means of telephones employed in conjunction with illustrations of various parts of the house. Dioramas and actual examples of good lighting are also included, together with the warning "Don't let poor lighting fray your nerves." In the Design Section Troughton & Young,

Advice on lighting problems is given on the E.L.M.A. stand by means of telephones

Best & Lloyd, and Oswald Hollmann have joined together in producing an exhibit indicating recent advances in lighting fitting technique. This display also includes examples of other types of electrical apparatus, particularly streamlined products made by various other manufacturers. Among these we noticed a new H.M.V. wide-angle reflector fire.

A special feature of lighting fittings is also made by Berry's Electric, in the inner sanctum of whose stand the history of the "Magicoal" imitation coal fire and the new "Chameleon" fireplace is told in an attractive fashion. Most of the lighting fittings shown by Harcourts have been specially designed to harmonise with almost any scheme of decoration.

Electro-medical apparatus is represented by Hanovia ("Homesun" lamps), Hinders ("Summasun" and "Radiaray" lamps) and the General Inductance Co. ("Giplex" infra-red ray apparatus). The "Localamp" adjustable spot lights and the "Gilda" hairdryer are also shown among the exhibits of the last-mentioned company. In addition to the well-known "Empire" trouser pressers, W. T. Driver also have fan heater attachments and the "Kluge" dry shaver. The "Mixmaster" mixing machine and the "Ironmaster" streamlined iron are two of S. Guiterman & Co.'s exhibits, and a full range of electric clocks is presented by Bulle Clocks. The interchangeability of the "Wylex" plugs and sockets is demonstrated on the stand of George H. Scholes & Co., who have just brought out a 15-A switch-plug, claimed to be the smallest on the market.

Two further interesting demonstrations are given on the stands of the London Section of the Institution of British Launderers and F. H. Eve. The former includes an up-to-date electric laundry, while on the latter visitors can see how "Everite" electrical equipment is used in modern millinery.

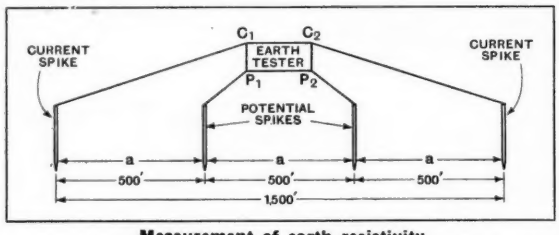
High-voltage Lines and G.P.O. Circuits

By John McCombe, Ph.D., A.M.I.E.E.

WHEN the route of an overhead high-voltage power line is being surveyed, the proximity of telephone circuits must be considered. Separating distances are stipulated in the Post Office memorandum on "Protection of P.O. Circuits from High-Voltage Power Lines." The minimum distance between any part of a high-voltage line and a Post Office line must not be less than $(H+d)$ or $1\frac{1}{2}(h+d)$ whichever is the greater where H and h are the heights of the power and P.O. lines at supports and d is the distance in ground level.

Where the power lines and G.P.O. lines are parallel to one another for any appreciable distance, a much greater distance must be allowed, as the value of the induced voltage in the P.O. circuits must not exceed 300 V in the event of a short-circuit between one phase and earth.

The values of induced voltages in P.O. circuits by the parallelism of high-voltage power lines can be determined mathematically. The method is divided into three stages as follows: (a) Determination of depth of equivalent earth return path; (b) calculation of mutual inductance between the circuits; (c) calculation of the induced voltages in P.O. lines.



Measurement of earth resistivity
Let R="Megger" reading (ohms) and a distance between spikes (ft.). Then resistivity $=2\pi aR$ ohms per cm. cube.

When a short-circuit occurs between a phase and earth it is assumed that the maximum fault current will travel to a depth, D metres, in the earth, called "depth of equivalent earth return path," depending upon the resistivity of the earth. It can be determined from:

$$D = \frac{2.2}{\sqrt{4\pi CW}} \text{ cm.,}$$

where C is the conductivity of the earth per cm. cube in c.g.s. units $= \frac{1}{\text{resistivity} \times 10^9}$ and W is 2π times the frequency of the system.

If the value of earth resistivity and the frequency of the system are known it is a simple matter to determine the value of D.

Resistivity varies greatly for different kinds of strata and the following method is often employed to determine the resistivity in the particular case. Four spikes are driven into the ground in the straight line of route at regular distances of 500 ft. The two outer spikes are the current spikes and the two inner the potential spikes. Cable leads connect the spikes to a "Megger" earth tester. The value of the resistance between the inner spikes is read direct in ohms; *i.e.*, resistivity $=2\pi aR$, where a=distance separating spikes in ft. and R=reading of earth tester in ohms.

The mutual inductance, M, of the lines is dependent on the distance in metres, S, separating the two lines and also on the value of D, obtained as in (a). It is expressed as follows:

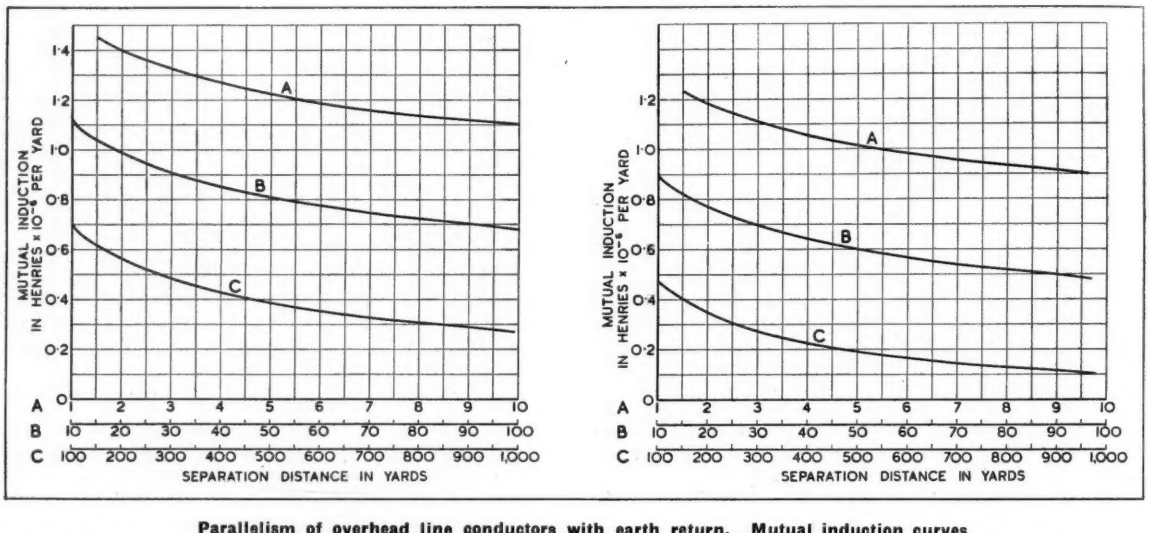
$$M = \text{Log } e\left[1+\left(\frac{2D}{S}\right)^2\right] 10^{-4}$$ henrys per kilometre of parallelism.

Curves can be plotted with separating distance in yards as base, and mutual inductance in henrys as ordinates for any given value of earth resistivity.

Induced Voltage in P.O. Lines

Voltage induced in P.O. lines $(E)=2\pi f(ML)\ I$ volts, if I=maximum fault current in amperes and L=length of parallelism in kilometres. Where an aerial earth wire is run on poles, the calculated value of I can be reduced by one-third. Furthermore, if the telephone circuits are sheathed, the induced volts can be taken as 0.7 of the calculated value and if there is armouring in addition the factor becomes 0.6.

Practical tests are sometimes carried out to determine the actual value of induced voltage. The method is as follows: An overhead line is shut down and one phase is used for the tests. A resistance of a known value is inserted between this conductor and the earth at the end remote from the source of supply the line is then energised from the generating station at a low voltage. In this way a known value of earth-fault current is obtained. The induced voltage is then measured. The value of the resistance is altered so that a new value of earth fault current is obtained. The line is again energised at the same low voltage and the induced voltage measured. The value of the induced voltage per ampere per mile of parallelism for a known value of fault current can be calculated. The practical values can be compared with the calculated values obtained as shown above.



Parallelism of overhead line conductors with earth return. Mutual induction curves
Separating distances A, 1-10 yds.; B, 10-100 yds.; C, 100-1,000 yards. In the left-hand curves the earth resistivity= 30,000 ohms per cm. cube, and the depth of equivalent earth return path D=1,935 metres. The figures for the right-hand curves are 3,000 ohms and 610 metres respectively.

Corrective Lighting

ROWLANDS ELECTRICAL ACCESSORIES, LTD., has constructed at its head office in Birmingham a special dark room for demonstrating its "Realite" balanced light principle of colour correction of mercury discharge lamps. The demonstration room is divided into sections by means of sliding curtains and each compartment or cubicle is provided with display stands on which coloured objects are mounted. It is possible from one position to view articles of an identical colour under three different light qualities known as commercial, high and super mix. The demonstrations have proved so successful that similar dark rooms are being constructed at the company's London and Manchester depôts.

The Field of Luminous Flux. By Prof. G. W. O. Howe

Is it a useful concept ?

DURING the last week of June, 1937 an International Illumination Congress was held in Paris at which two reports were read by A. A. Gersun, a Russian scientist, summarising his 176 page monograph "Le Champ Lumineux," published in Moscow in 1936. These reports were published in the *Revue Générale de l'Electricité* of July 3rd, 1937. In the same journal of November 6th, 1937, M. André Blondel submitted M. Gersun's reports to a very severe criticism, maintaining that his methods were to some extent fallacious, and all of very little practical utility. Now after more than a year M. Gersun publishes a paper in the same journal (September 10th, 1938) attempting to meet the criticism of M. Blondel, who, however, returns to the attack in the same number.

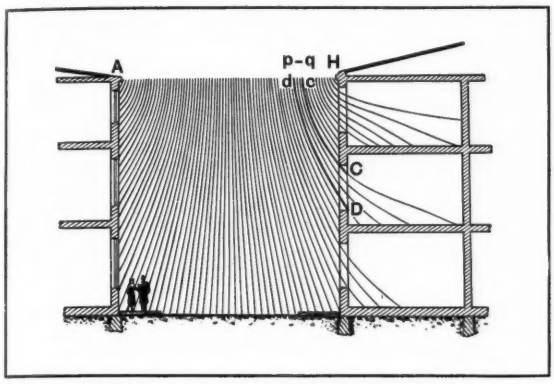


Fig. 1.—Diagram of lines of flux in an area illuminated by diffused daylight

Generally speaking, the proposals of M. Gersun consist in the application to the problems of illumination of the concepts and technique developed in connection with electric and magnetic fields, and M. Blondel maintains that it will not work and that the results are very misleading. M. Gersun's proposals are not always easy to follow because, as M. Blondel points out, he sometimes uses terms in an unusual manner, and one has to gather their meaning from the context.

He defines a luminous field as space considered from the point of view of the transmission of radiant energy which takes place in it, but he then narrows this conception down by saying that the problem is regarded photometrically and not electromagnetically, from which one gathers that his radiant energy is to be measured by the illumination that it is capable of producing, and that when he writes cU, where U is the density of radiant energy, and c the velocity of propagation, he is using these terms either in a very loose or in a highly specialised sense.

M. Gersun introduced two new concepts, one scalar and one vectorial. The first is the *spatial illumination* at any point in space. It is four times the average illumination over the surface of a small sphere placed at the point. It gives equal weight to light coming in any direction. As Blondel remarks, this may be of importance to the plankton floating in the atmosphere. The second concept is the *luminous vector* which he defines as follows: If a small plane screen be placed at a point and turned into such a position that the *difference of illumination* of its two sides is a maximum, then the vector drawn normal to the plane and equal in length—to some scale—to this difference of illumination is called the luminous vector at the point. If the screen is now turned in any other direction, the difference of illumination of its two sides will be given by the projection of the luminous vector on the normal to the plane, *i.e.*, it follows a cosine law.

M. Gersun's statement that this vector represents the quantity of energy transmitted in unit time across unit area, and still more so his reference to Poynting vectors seem very doubtful extensions of the purely photometric data. M. Gersun himself points out that unlike the electrostatic field where the effect of a charge is the same in every direction, so that the force on a unit charge depends only on the distance from another charge and not on the direction, the effect of a bright surface depends both on the distance and on the direction. The conception of potential and equipotential surfaces cannot be introduced, and surfaces of equal illumination —isolux surfaces—are not orthogonal to the lines of luminous flux.

But although he seems at times to realise the fictitious character of his tubes of luminous flux, his language is often very misleading. He says, for example, "The engineer and the savant speak of the flux of light." "The radiant energy may be supposed to be distributed throughout the space in a continuous manner like a flowing liquid." We shall see shortly how fallacious and misleading this analogy is. Again, "we arrive thus at a conception of the radiant energy as consisting of threads of some fluid. This transmission of energy takes place as if the energy flowed along the tubes of luminous flux. This idea may be very valuable." Blondel has grave doubts as to the value of the idea and says that it is fallacious.

Fig. 1, which is reproduced from Gersun's paper, is entitled "Tracé des lignes de flux dans une zone éclairée par la lumière diffuse du ciel." The language employed certainly suggests that the luminous energy which enters the window CD is the same energy as that which crosses the section *cd* and flows down the tube of flux. Now Gersun never really says this; he is careful to say that the energy crossing any cross-section of the tube is merely equal to that crossing any other cross-section, but his language, and especially his references to stream lines in a liquid, certainly give this false impression.

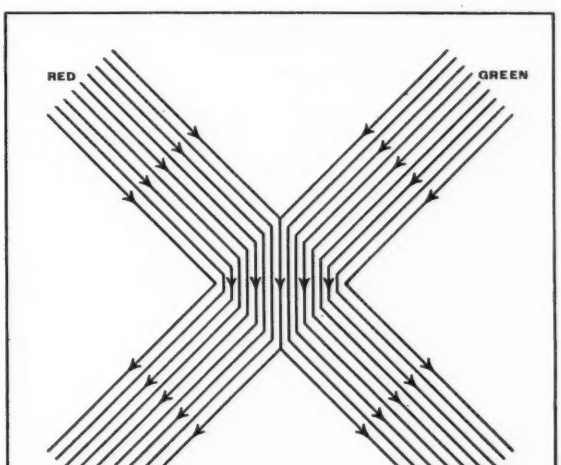


Fig. 3.—Flux produced by crossing searchlight beams

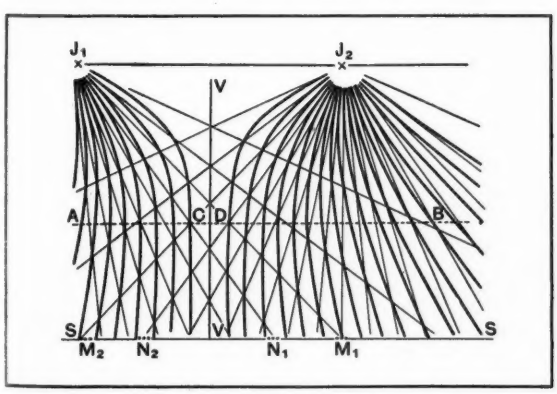


Fig. 2.—A roadway illuminated by two lamps

Everyone knows that the light entering the window comes from all visible parts of the luminous sky, and least of all from the part pqH, which could only illuminate the floor near the window. The figure gives an entirely false idea of the flux of light. The curves are little, if any, more than mathematical abstractions since they merely represent the lines traced by a small disc which is always held so as to have the maximum difference of illumination on its two sides and is always moved along the normal to its surface.

Fig. 2 shows another case about which there has been much controversy, it is reproduced three times in the pages of the journal referred to. It shows a roadway illuminated by two

lamps and the lines of luminous flux radiating from each lamp have been compounded by M. Gersun to give the resultant field of luminous flux. After the reference to stream line flow of liquids could any diagram give a more misleading

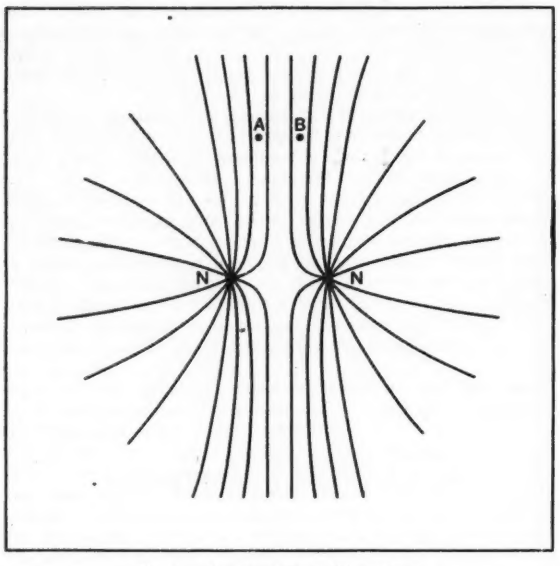


Fig. 4.—A magnetic field analogy

picture of the path followed by the light? As Blondel points out, it suggests that one could insert a vertical screen at VV¹ without any light falling upon it, although M. Gersun would be the first to disclaim any such interpretation of the diagram.

These lines of luminous flux certainly suggest that the illumination of the ground to the left of V¹ is due entirely to light from the left-hand lamp, and that to the right of V¹ to light from the right-hand lamp, whereas anywhere in the neighbourhood of V¹ the illumination is really due in almost equal amounts to both lamps. The curves do, however, give at every point the direction of the resultant or maximum transmission of luminous energy, and as M. Gersun points out, they would be entirely altered by the insertion of a screen at VV¹.

In my opinion, however, fig. 3 gives a far better example of the misleading character of Gersun's luminous flux than anything in the articles referred to. It shows two searchlight beams, one red and one green, crossing at right angles. In the square occupied by both beams the resultant flux has been drawn in accordance with M. Gersun's method, and the diagram now shows the tubes of luminous flux. One is entitled to ask by what magic the emerging beams have the colours that experience shows them to have.

In justification of his diagrams M. Gersun might say with some truth that the same objection could be raised in connection with the analogous magnetic field diagram in fig. 4 which shows an end view of two parallel bar magnets with their like poles towards us. This diagram gives the impression that the magnetic field at A is due to, and associated entirely with, the left-hand magnet, whilst that at B is associated entirely with the right-hand magnet, whereas everyone knows that both at A and B the effect is due in almost equal measure to both magnets. Neither in the luminous nor in the magnetic case is there any justification for endowing with any kind of physical reality lines which are merely geometrical loci. It is the attempt to do so that leads people to propound such meaningless questions as whether, on rotating, say, the right-hand magnet in fig. 4 about its axis, its field will rotate while that of the left-hand magnet remains stationary.

Although it is, perhaps, hardly fair to judge M. Gersun's proposals from a mere summary of a monograph of 176 pages, I must say that, so far as one can judge from the articles referred to, their disadvantages outweigh any advantage that they may have.

Orders for Electric Lifts

Bennie Lifts Co., Ltd., has obtained a further contract from the proprietors of Hay's Wharf, Ltd., for a 30-cwt. variable voltage high-speed goods lift, and also a further contract for two high-speed fully automatic service lifts for the new Liverpool Airport, Speke. Other orders recently received by the company include installations at the new H.M.V. premises in Oxford Street and the physics extensions at Oxford University.

Here and There

By Nomad

AT Croydon the other day I saw what progress has been made with the new cooling tower at the electricity works. It is now about 40 ft. high and it will have a capacity of 1,500,000 gallons per hour. It was approved by the Central Electricity Board in 1936 and it brings to notice the recent spate of cooling-tower station extensions. Another tower approved in the same year is that at Hams Hall, Birmingham, which I saw last week completed and in use. It has a capacity of 2,650,000 gallons per hour, but still larger units (3,500,000 gallons) are those at the Neepsend and Blackburn Meadows power stations of the Sheffield undertaking which I saw under construction last year. I understand, however, that the first tower to be built for Hams Hall B. is to have a capacity of the order of 5,000,000 gallons per hour. This is certainly the largest capacity I have heard of for a cooling tower. Can readers tell me of any others as large or larger?

* * *

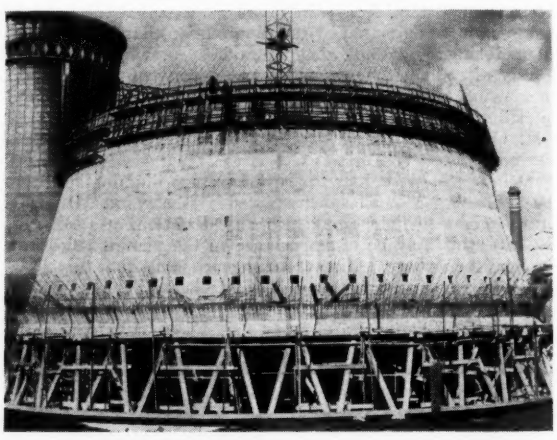
Just to show that public-supply stations haven't got it all their own way I may mention the private-generation scheme of Powell Duffryn Associated Collieries, Ltd. All the stations on this system depend on cooling towers and I have seen the recently completed 700,000 gallons per hour tower at Middle Duffryn. What interests me most in this system, however, is the steam compounding at Bargoed by the installation of two 1,500-lb. per sq. in. boilers. Mr. D. R. Williams, technical engineer, told me that the HP steam will first be passed through a 6,500-kW high-pressure turbine and, after reheating, delivered to the normal low-pressure steam range—like the scheme at Bradford.

* * *

Another very high-pressure steam installation which impressed me is that by Babcock & Wilcox, Ltd., at the Ford Motor Co.'s Works, Dagenham, but in this case more particularly because of the firing arrangements. It is the only case I know of where boilers are equipped for three different means of firing—pulverised coal, blast-furnace gas and coke-oven gas. At the time of my visit one of the boilers was being equipped for supplementary firing by gases to be produced from the kilning of house refuse.

* * *

Steaming conditions have a bearing on an interesting recent discussion. It arose out of the tendency nowadays to style what would, at any rate in the light of a few years ago, otherwise be power station extensions, as separate power stations. Those instances which I can call to mind all have higher steam conditions for the "extensions." For instance, Clarence Dock No. 1 station has 450 lb./sq. in. and 750 deg. F., while Clarence Dock No. 2 station has 630 lb./sq. in. and 825 deg. F.; at Brimsdown A the pressure is 160 lb./sq. in., while the pressure at Brimsdown B is 325 lb./sq. in.; and at Barking the pressures at the A and B stations are 375 lb./sq. in. and 625 lb./sq. in., respectively.



[*Elec. Rev.* photo.

The cooling tower at Croydon under construction

The question is, however, do the changed steam conditions, with consequent reflections on the operating costs, govern the separate-station idea, or is it merely a question of financial classification, or even of actual physical separation of the buildings. I see that in the Electricity Commissioners' "Fuel Returns" for 1938 it is said that "where stations have been built in sections in separate buildings each section has been counted as a separate station for the purpose of this Return."

Photographic Illumination

By T. Thorne Baker, F.Inst.P., A.M.I.E.E.

A study of the needs of film and photographic studios, the illuminants available and possible developments.

THE needs of the commercial photographic studio and the motion picture producer have led to considerable fresh attention being paid to the subject of artificial daylight. In past years the physicists of Europe and America have had endless discussions about primary and secondary light standards for photometric purposes, and light filters have been evolved which, when used to screen carefully controlled incandescent lamps, give a dependable light source of definite colour temperature. But in such cases, of course, economy need play no part, as it must do in industrial photographic picture making.

While the constant improvement in the speed or sensitivity to light of photographic emulsions* has enabled the black-and-white camera man to work with less and less light in the cine studio, the rapidly expanding art of natural colour photography has re-introduced the need for ample light, and has brought with it the old demand for artificial daylight. A studio set being photographed in colour, at twenty-four pictures per second, with a lens aperture of F/2.3, will require illumination ranging from 400 to 1,200 ft.-candles.

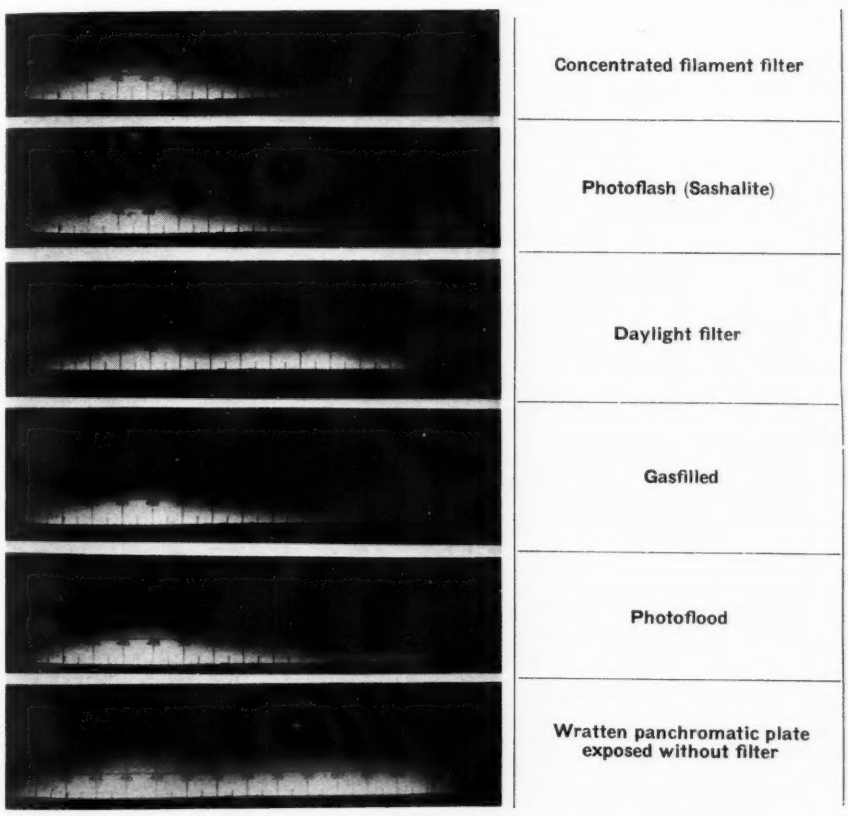
It may be taken as more or less axiomatic that natural colour films are acceptable to the eye only when the colours look "as they would do in daylight." Hence all colour processes have been tuned up to give reproduction which simulates those colours as seen by the eye in light of a colour temperature of about 5,000 K. Gasfilled lamp lighting, although it has undergone immense improvement and may yet come out triumphant, is at present eclipsed by the brightness efficiency and concentration of the arc. A paper read by Noel and Farnham at the Spring Convention of the Society of Motion Picture Engineers disclosed the fact, however, that water-cooled mercury arcs, burning in pressures of half a ton per sq. in. upwards, will give light having a practically continuous spectral emission, with a very fair proportion of red rays, and hence of a fairly "white" character. While these lamps are still largely in the laboratory stage, of their ultimate use in the photographic field in many directions there is not the slightest doubt. Experimental work now in hand in combining a suitable proportion of cadmium with the mercury is hoped to lead to an almost perfect continuous spectral emission truly representative of daylight.

The Mole-Richardson arc, which is being used on an increasing scale in English and American studios, has many advantages. It is very constant, although there is a good deal of trimming to be done. The high intensity arcs, running at 125 A upwards and burning special daylight carbons, require no camera lens filters and only the pale straw-coloured gelatine which is used over the lamp itself, in order to obtain a real "daylight" effect. This may sound a somewhat sweeping statement, but it is a fact that the colour temperature of a studio illuminant must be within very strict "daylight" limits in order that the colours shall be correctly rendered, and that both "Technicolor" and "Dufaycolor" film can be "shot" in this light without a filter over the camera lens. The broadsides and scoops, having a slightly lower colour temperature, do not require the straw-coloured filter.

In co-operation with the General Electric Co. of America, a blue pot glass material has been evolved which, used as a filter in front of the new type of "colour photography" gas-filled incandescents, gives also a very fair daylight spectrum. Incandescent and Mole-Richardson arc *and* daylight illumination can thus be indiscriminately mixed in the studio or outdoors, and this represents an advance of considerable importance in cinematograph lighting technique, which has been aimed at for years past.

The motion picture field, however, is by no means the only one of importance to-day, especially in the United States, where commercial photography has gone ahead by leaps and bounds in recent years. The photographer in this country who takes a photograph for an advertising agency may get anything from two to twenty-five guineas for a picture, rarely the latter figure, but in the United States it is an everyday transaction to pay $1,000, or £200, for one really first-class advertising photograph.

Most of these photographs are taken in commercial studios by artificial light, photoflood, gas-filled, or photoflash bulbs. The photoflood lamp, with its high colour temperature, a result of over-running, has a naturally short life of, say, two to twenty-five hours. The normal incandescent lamp offers complications because the concentrated filament type has a whiter light (actually bluer) than that of the large ordinary filament type, and needs a separate filter. Hence various types of lens filters have become necessary, and the accompanying wedge spectograms indicate the subtle differences which it is absolutely necessary to maintain for a range of filters for a particular colour film in order to obtain pictures of uniformly correct colour rendering.



Wedge spectrograms of gasfilled light unfiltered and with a typical series of filters for various illuminants

We come finally to a matter on which some co-operative action is becoming very desirable, and that is the spectral emission of photo-flash lamps. Many thousands of these lamps are used daily, and the number is continually increasing. So, unfortunately, is the variety of flash bulbs being manufactured, there being now the foil type, the wire type, and the combined foil-wire type. The makers of flash bulbs have lost sight of the fact that photography is rapidly changing over to *colour* photography, and that each and every type of lamp at present requires its own individual filter. It represents a serious amount of extra laboratory work and the carrying of unnecessarily large stocks, and there is as a consequence some tendency to return to the old-fashioned flash powders. The

* The recently discovered Agfa panchromatic emulsions, now being used on a large scale at Hollywood, have from three to four times the speed of emulsions previously used and have entirely changed the aspect of studio illumination.

mixture of foil and wire has proved to be the most useful type so far for colour photography, and by varying the proportion of foil to wire and using a standard metal or alloy, an agreed spectral emission could be arrived at, for which one filter could be used for any one colour process.

For projection work the high-intensity arc still holds the field and is proving a highly satisfactory light source; the size of theatre screen and the screen brightness in foot-lamberts* is becoming internationally standardised, and much improvement will now be made in this respect as the result of the report of the committee recently appointed by the Society of Motion Picture Engineers to investigate this subject. But here again we are promised important developments in the high-pressure mercury arc,† which can be made to give more candles per sq. cm. than the carbon arc, and has the decided advantage of requiring no attention while running. Some of the ultra-high-efficiency lamps have run for 2,000 hours, maintaining a constant output.

The "cold-light" fluorescent lamps which have recently been demonstrated by the Westinghouse Electrical and Manufacturing Co. and the American General Electric Co. before the New York Electrical Society are not likely seriously to affect the position as regards photographic studio and cinematographic lighting. The best of these lamps, using the ultra-violet rays from mercury at low pressure and fluorescent substances deposited on the inner walls of the bulbs, has an efficiency of 60 lumens per watt for the 30-W size. Freak lamps, which may become "production" lamps in the near future, have shown an efficiency as much as 200 times that of the ordinary gasfilled type. But the illumination from a fluorescent coating is extremely diffuse, and has a remarkably low photographic efficiency, and for studio work they would have to be backed up by spot lights of arc or concentrated filament type in order to obtain the contrast and dramatic effect indispensable for modern photography.

* A lambert is the brightness of a perfectly diffusing surface emitting or reflecting one lumen per sq. cm. It equals $\frac{1}{\pi}$, or 0.318 candles per sq. cm.

† An intrinsic intensity of as much as 180,000 candles per sq. cm. has been reached by water-cooled mercury arcs, which is greater than that of the sun.

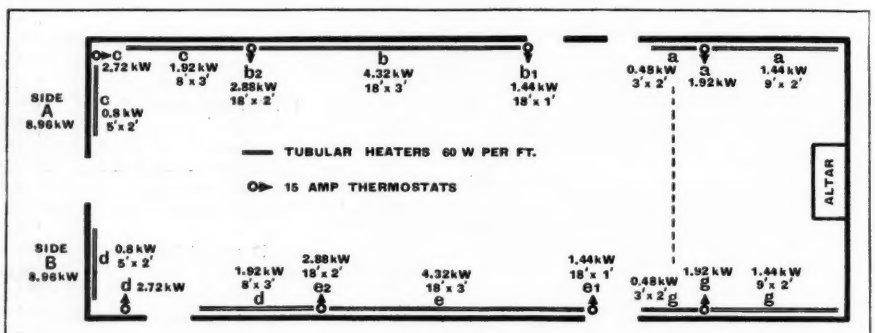
Small Direct Heating Installations

By a Heating Engineer

Reduced installation and running costs with electricity

AT first sight it might appear that the electric heating of large buildings, such as churches, meeting halls, &c., would not prove so economical as in other buildings due to the relatively short hours of heating required. Considering the appreciable cost which has sometimes to be incurred in making supplies available and the relatively small revenue, together with the poor load factor, such a view may be in some measure correct. For smaller buildings, however, having volumes up to 50,000 cu. ft., which are used for only a few hours per day, the converse often applies.

In such cases it is often possible to afford supplies from the existing network, and to install thermostatically controlled tubular heating and convector installations at a considerably lower initial cost than for the alternative low pressure hot-water system, without even taking into account the indirect savings and advantages of the electrical scheme. These include flexibility, uniformity of temperature and control, and reduction in building costs by the elimination of boiler houses, flues, &c.


C 2.72 kW
C 1.92 kW 8' x 3'
b2 2.88 kW 18' x 2'
b 4.32 kW 18' x 3'
b1 1.44 kW 18' x 1'
a 0.48 kW 3' x 2'
a 3 1.92 kW
a 1.44 kW 9' x 2'
SIDE A 8.96 kW
C 0.8 kW 5' x 2'
TUBULAR HEATERS 60 W PER FT.
15 AMP THERMOSTATS
ALTAR
SIDE B 8.96 kW
d 0.8 kW 5' x 2'
d 2.72 kW
1.92 kW 8' x 3' d
2.88 kW 18' x 2' e2
4.32 kW 18' x 3' e
1.44 kW 18' x 1' e1
0.48 kW 3' x 2' g
1.92 kW g
1.44 kW 9' x 2' g

Church heating installation with a total installed loading of 17.92 kW (approx. cubic capacity 14,000 sq. ft.)

Often the short hours of usage do not justify maintaining low pressure hot-water systems continuously in commission during the winter months; therefore the boilers are invariably relighted each time the building is required. This especially applies to small country churches, meeting rooms, &c., and in order to raise the building up to a reasonable temperature the boilers have often to be lighted several hours before the building is actually used, so incurring labour costs and considerable wastage of fuel. A further point is that when such buildings are in use they are usually well occupied, little additional heating being then required beyond the initial heating. In such circumstances it is very easy for overheating to result.

By installing a somewhat higher loading than usual, such buildings can be heated electrically in 20 to 30 minutes, no labour costs being involved, and all the disadvantages of the low-pressure hot-water system are eliminated. Due to the constant relighting of the boilers and the subsequent wastage of fuel, the operation costs of the electrical scheme will often prove competitive at a relative high cost per kWh.

The foregoing is exemplified by a typical installation which is illustrated by the accompanying diagram. The capacity of the building is approximately 14,000 cu. ft., and approximately 18 kW of tubular heaters loaded at 80 W per ft. have been installed. These were supplied from a single-phase, three-wire network, the load being split and equally balanced on each side. Control of the heating is effected by eight 15-A room thermostats situated in the positions indicated in the figure.

The total cost of the installation, including wiring (lead-covered cable) £24, amounted to £70, as compared with an estimated cost of £105 for a low-pressure hot-water system. The operation costs from the end of October up to May 7th last were as shown in the table for an average usage of one hour per day, with the exception of Sundays and Wednesdays, which have been four hours and two hours respectively.

Assuming a further 500 kWh consumed to complete the heating season, the total annual costs work out at 1d. per kWh as £16 11s. 6d., at ¾d. per kWh as £12 8s. 7d., and at ½d. per kWh as £8 5s. 9d.

The fuel for heating by low-pressure hot water was estimated at 6 to 8 tons of coke per annum. Assuming a price of £2 per ton, it would appear that the electrical scheme is easily competitive at 1d. per kWh, considering the advantages, very much so at ¾d. per kWh and the cost at ½d. per kWh would seem almost too low for the service obtained.

CONSUMPTION OF INSTALLATION.

Quarter.	kWh consumed. Side A.	Side B.	Total kWh.
December, 1937— (Oct. 30th to Jan 1st).	621	662	1,283
March, 1938— (Jan. 1st to Mar. 30th)	777	833	1,610
June, 1938— (Mar. 30th to May 7th)	280	305	585
			3,478
Extra to complete heating season (estimated)			500
			3,978

The foregoing emphasises the wisdom of considering each type of heating installation on its merits before reducing the cost per kWh to the minimum. In this respect it might be mentioned that the usage of the type of installations described is usually in the early mornings and during the evening. In such circumstances it would be economical to offer a lower rate than the standard heating tariff, due to the off-peak nature of the load, yet it is not necessary in order to be competitive. The potentialities of this load in rural and, to a lesser extent, urban areas is obvious.

A further interesting point is the accuracy of the balance of the installation described as evinced by the respective consumptions on sides A and B, obtained by the use of ordinary room thermostats, which is important in rural areas.

Electricity in Factories

Report of the Senior Electrical Inspector

FROM curves included in "Electrical Accidents and Their Causes" for 1937—the annual Report of Mr. H. W. Swann, Senior Electrical Inspector of Factories (Form 929, Stationery Office, 9d.)—it appears that the total number of accidents tends to be proportional to the amount of energy used for industrial purposes. There were 583 accidents reportable under the Factory and Workshop Acts of which 36 were fatal, one more than the previous highest recorded of 35 in 1929. In addition, 37 fatal accidents occurred in other miscellaneous industrial premises, 22 in domestic premises (five in bathrooms) and eleven in places of a similar character, making a known total of 106 compared with 112 in 1936 and 87 in 1935. In twelve cases of electric shock artificial respiration was successfully applied. Unskilled men were involved in about 60 per cent. of the 583 accidents.

The greatest number of accidents, 152 (nine fatal) was associated with switchgear, a large number of the 120 accidents at 650 V or less being due to the use of metal tools on live equipments. Cables and flexibles came next with 90 accidents (seven fatal) due either to the use of defective flexible cable in connection with portable apparatus or to damage to temporary or inadequately protected wiring. Often in the former case failure of the cable at the point of entry into the tool or the plug was responsible, and the use of a reinforcing rubber sleeve and cable grip is recommended; in the second group much of the trouble is in connection with buildings in course of construction.

Eye flash from welding shows a slight increase owing to inadequate screening or the non-use of the goggles provided. Last year saw an increase of 48 per cent. in the number of accidents ascribed to testing, many due to connecting low-voltage lamps across higher voltage circuits; the lamps should be enclosed in an insulating box and protected by fuses of adequate short-circuit capacity. Flexible cables should not be used as earth leads except in conjunction with earth spikes. For inspecting empty drums that have contained liquids giving off inflammable vapours only appropriately certified lamps should be employed. Eighteen deaths were attributed to voltages between 250 and 650, two of them with DC. Seven occurred with AC at less than 250 V and one with static electricity due to the ignition of petrol while rinsing garments.

Switchgear Accidents

Under the heading of "Electricity Supply Industry" (covering five fatalities reportable under the Act and six otherwise) is presented a table setting out the main features of seven switchgear explosions, which caused injuries and the death of three men, and eleven explosions that were unattended by personal injury. In one of these instances an operator died as the result of burns received from oil ejected from a high-voltage switch which flashed over internally (due to small clearances) while being closed by hand on a faulty circuit. Other failures were due to inadequate short-circuit capacity, insulation breakdown or flash-over of insulators. Some of the last-named occurred during thunderstorms. One high-voltage breaker operated for six years (up to six times a day) until slight internal damage owing to a flash-over last year caused it to be opened, when it was discovered that oil had been omitted on installation.

Reference is made to A.R.P. Memorandum C2, in which are advocated the separation by distance of different sections of switchgear and the construction of switchhouses of 14-in. brickwork or 12-in. reinforced concrete covered by a concrete roof with a minimum thickness of 5 in. For relief of internal pressures set up by switchgear failure the use of a collapsible wall is recommended. Protection from shell splinters would be obtained by a traverse wall to protect the collapsible side of the switch-house, but offset sufficiently to allow of access.

Among the transformer failures in 1937, three explosions were due to arcing under oil at the contactors of tap-changing gear, which resulted in "tracking" from the deposit of carbon on horizontal insulating surfaces. In four cases skilled men forgot that the bus-bar isolators in cubicle gear would be alive if the associated circuit were alive from the duplicate bus-bars; one man was killed in this way and five seriously burned. Another recurring type of accident is that in which access is obtained to live socket contacts on metal-clad gear through neglect to lock all spout covers where the contacts are alive.

Particulars are given of two bus-bar faults that occurred at the same station in order to point to the need for serious consideration of bus-zone fault protection, either fully automatic or indicative, time rating of neutral earthing connections in relation to the system protective gear and the design of earthing systems in view of voltage rises as well as short-circuit current. As an alternative to bus-zone protection, an adaptation of the "mesh" system, eliminating bus-bars, is put forward. In this the alternators feed into, and the feeders radiate from, a ring main, between any two points on which automatic circuit-breakers (capable of carrying the maximum ring current are installed); isolation of any circuit requires the tripping of two breakers and the opening of the circuit isolator. For the routine testing of switchgear insulation an ohmmeter or power-factor measurement is to be preferred to the application of excess voltage, especially if the insulation is old.

Concurrence has been expressed by representative associations of the supply industry to maximum values of fault input and transformer capacity in sub-stations at cinemas as set out in the Report. From information compiled by the Fire Offices Committee relating to 589 electrically caused fires within two years, it appears that 43 per cent. were due to insulation failure of wiring, apart from failures of apparatus and flexibles, which caused 41 per cent. A further 8 per cent. are ascribed to leakage current flowing to gas pipes. In many forms of insulation failure, earth leakage precedes short circuit, and overload protection should, where required, be supplemented by earth-leakage protection. On three-phase loads this can be actuated by the resulting phase unbalance; in other cases the rise of potential in earth continuity conductors can be employed to trip resistive circuit breakers connected between the metal work of the installation, and operating at 30 V, and of sufficiently high resistance to be independent of the resistance of the return earth path. Questions as to whether the ordinary earth wire should remain and the conditions under which multiple protective earthing might be effective are discussed. Excess current protection of factory distribution systems also receives consideration at length.

A sub-station damaged by a switchgear explosion

The existence of an earthing conductor increases interference with radio reception by portable tools. Suppression by condensers only may necessitate values of capacity that would cause slight shocks to persons handling the tools, as the condensers are connected to the metal casing. These values may be reduced by connecting chokes in series with the line or with the earthing conductors, but the latter arrangement would add to the resistance of the earth connection and would short-circuit the inductance if the tool were used for work on earthed metal. It is anticipated that chokes combining effective suppression with practicable dimensions will become available for connecting in the line.

An important section of the Report deals with portable electrical apparatus for which the use of transformed voltage is advocated. A method of controlling the supply to a portable tool by means of a contactor, the operating coil of which is energised from a battery or low-voltage transformer, is described. Other paragraphs relate to travel-limit switching devices, steel furnace chargers, the risk of failure of the wall of high-frequency induction furnaces (causing water violently to expel red-hot metal from the crucible), static electricity, conductive rubber, inflammable conditions and precautions that should be taken in electrical testing.

Meetings and Discussions

Three further I.E.E. Chairmen's addresses are dealt with in this issue—those of the Wireless and Meter and Instrument Sections and Mr. McNeill's review of telephony in Eire before the Irish Centre in Dublin. The discussion on Dr. Allibone's paper on long-spark phenomena (dealt with in our last issue) called forth the views of a number of eminent research workers and was preceded by a fascinating demonstration. The high cost of patents was mentioned by Sir James Swinburne at a meeting of the Institute of the Plastics Industry and stand-by plant was discussed at the I.E.C. last evening

Protecting Communication Circuits

PROTECTIVE devices used in telecommunication circuits, some of which might prove to be of definite value in other directions, were discussed by Mr. B. S. Cohen (P.O. Research Station, Dollis Hill) in his inaugural address as chairman of the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 4th.

It was explained that the various kinds of circuits and the apparatus terminating them required protection against lightning discharge and against direct contact with, or inductive surges generated by, power circuits or any other extraneous sources of over-voltage.

With telephone circuits the major requirements were to protect the subscriber and his instrument, and the exchange and apparatus therein. Other devices might be needed at intermediate points to minimise the effects of surges on line plant, or to localise their effects on open wire plant.

For power circuits, comparatively few devices sufficed to protect a large extent of network, whereas in telephony each individual circuit required its protective devices. The numbers required in Great Britain alone consequently ran into millions. Again, telephone cables had dry-paper insulation and would break down at about 1.5 kV. As the dielectric was air, there was negligible delay action, so that the protective devices must be both more sensitive and rapid in operation than those used for power-cable protection.

For the development of protective devices one might regard a lightning stroke as, in general, a discharge from a negatively charged cloud with an average duration of the order of 50 microseconds. A typical rate of voltage rise for surges induced in lines was 1,000 kV per microsecond, although much higher rates had been recorded.

Lessons from Storm Damage

The series of thunderstorms of unprecedented intensity for this country which occurred during this summer, mainly in the South-West and West of England, while doing an exceptional amount of damage, produced instructive phenomena. Open wire telephone lines were fused in a considerable number of localities and it was possible to inspect some of the damage *in situ*.

In the majority of cases line wires of copper, cadmium-copper or bronze weighing from 40 to 100 lb. per mile (very exceptionally) *i.e.*, 50 to 79 mils in diameter, were fused at a single point and often with only a few inches near the break softened. But occasionally both 40 and 70 lb. line wires had been subjected to intense heat over an entire span or series of spans. The wire in those cases became completely annealed. On a basis of a 50 microseconds discharge the current necessary to raise the whole cross section of a 70 lb. bronze wire to incandescence would be of the order of 100,000 A.

In a number of instances the wires had been fused on the surface in small oval patches and the fused metal appeared to be drawn up into filaments, the tops of which had welded into projecting smooth nodules generally in one plane and always displaced in the same direction towards the ends of the fused oval patches. Similar nodular fusings were met with in arc discharges, the interaction between the magnetic field round the conductor and that at right angles round the arc causing a translatory motion.

A most remarkable case of fusing occurred at Rocester, near Stoke, where both wires of fifteen successive spans, involving over half a mile of 40 lb. cadmium-copper and normally 12 in. apart, had been neatly welded together. The longest continuously welded lengths were of the order of 30 ft. and, in addition, there were a very large number of short pieces fused at both ends, or fractured at both ends under conditions of high temperature. A considerable number of these pieces were about 12 in. long. This was possibly evidence of a recurrent series of peak current points.

The most likely explanation of this effect appeared to be that a steep-fronted discharge took place over the two wires in the same direction, the current tending to flow along a portion only of the adjacent faces of the wires (proximity effect) and might fuse this portion of the wire only. At the same time the magnetic field attraction (electro-striction) would draw the wires together. Somewhat similar electro-dynamic effects had been recorded abroad with v.i.r. insulated pairs, when the conductors had been forced through the insulation into contact with each other.

Illustrations of other sorts of lightning damage afforded evidence that most of it was caused by direct discharges on to the lines, and not by induced surges.

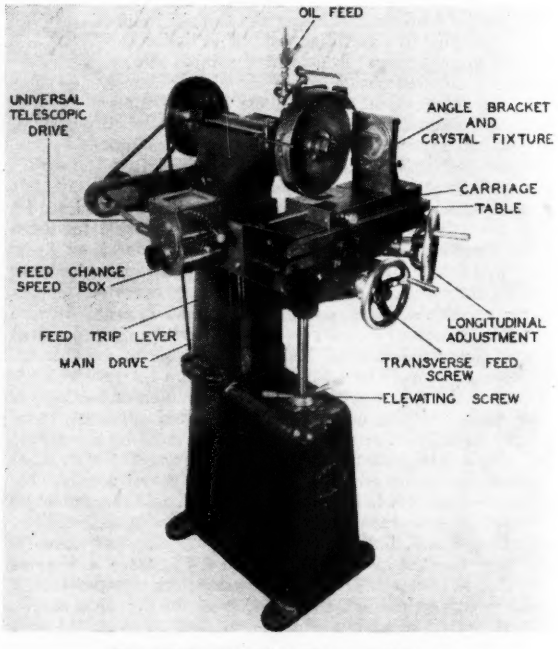
Protective devices could be subdivided into (*a*) high-voltage arrestors, such as pole earthing devices, chokes, spark gaps in air and at reduced pressure in gases; (*b*) fuses of the line type, or with delay action (thermally loaded heat coils), or of the exchange type with alarm attachments; and (*c*) acoustic shock-absorbers (voltage limiters). Mr. Cohen illustrated and described the various protective devices in general use, indicating how their design and construction were being improved, and utilising for demonstration the 600-kV impulse generator employed the previous evening by Dr. T. E. Allibone in connection with his paper on long sparks (see page 686).

Mr. Cohen's final words were reassuring. There were some 40 million subscribers in all parts of the world, yet he had been unable to find any record of a telephone user having been killed, or even injured, by over-voltage surges. Although line plant might suffer considerable damage, the harm done to telephones and exchange apparatus was almost negligible.

Post Office Radio Work

SOME of the more important radio developments recently made by the Post Office Engineering Department were reviewed by Mr. A. J. Gill in his inaugural address as chairman of the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 2nd.

He commenced by describing the ultra-short-wave radio equipment now in commercial service for telephone communication between the mainland and various islands. For frequencies up to 80 Mc/s, 1-100-350 W crystal-controlled transmitters had been designed for stand rack mounting and cubicle housing, occupying little space. Together with the superhetero-



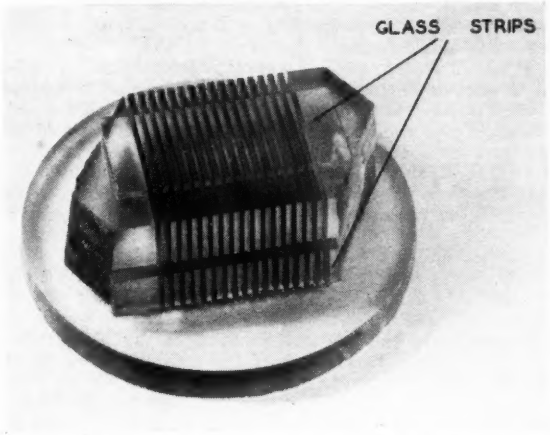
One of the crystal-cutting machines

dyne receivers, they were designed for unattended operation from 230-V 50-cycle AC mains, heavy-oil engine generators, rotary convertors, or batteries. The radio service could be inserted in tandem with standard 12-channel carrier telephone systems working over the 12 to 60 kc/s range, or, alternatively, would permit the use of multi-channel equipment produced for the co-axial system over the 60 to 100 kc/s range.

Communication Protective Devices
Post Office Radio
Telephony in Eire

In addition, for experimental purposes at up to 150 Mc/s (two metres wavelength), a similar 0.5-W transmitter had been employed successfully and a 100-W set was now undergoing tests. Provision was being made for the employment of differing kinds of modulator, so that investigations could be made with telephony, carrier telephony and television, the receivers being appropriately modified.

The results of propagation studies were not yet available, but on non-optical paths there was considerable fading at both 37.5 and 60 Mc/s, being more severe at the higher frequency. The depth of fades might be 60 db under exceptional circumstances, resulting in complete "wipe out" of the received field. Normal fading of 30 to 40 db was compensated for approximately by the automatic gain control of the receivers. The duration of the fades was usually short and very little deterioration of the traffic-handling capacity of the circuits from this cause had been observed.



Piezo-electric plates on slab base direct from cutting machine

Endeavours to correlate the field changes with meteorological conditions had not been successful, probably due to the meagre data available. During the period of intense sunspot activity in the early part of 1938 on the 60 Mc/s circuit the range of fields was 78 to 0 db (referred to 1 μV per m.) compared with 50 to 0 db in the spring of 1937; whereas on the 37.5 Mc/s circuit no departure from the normal propagation conditions was noticed, the 70 to 0 db range of fields being the same in both years.

The Post Office communicated the design of its portable field strength and voltage measuring set to manufacturers, so that similar types are now available commercially. An ultra-short-wave set with a 20 to 75 Mc/s range had since been made, the novelty of both being the application of the thermal noise method of calibration to the higher frequencies.

Vertically polarised receiving systems were much more susceptible to short-wave interference caused by motor car ignition systems. A reduction of 25 db had been obtained by changing over to horizontal polarisation and material diminution had followed the reduction of wavelength from five to two metres. Privacy of radio conversation had been secured by channel switching with the aid of automatic uniselectors.

Piezo-electric Crystals

Mr. Gill next turned to the precision measurement of frequency, suggesting that the present accuracy of $\pm$ 1 part in 10^7 obtainable with valve maintained elinvar tuning forks would in the near future be improved to $\pm$ 1 part in 10^8 by the use of piezo-electric quartz crystal oscillators. The upper frequency of a ring operating on an overtone of a circumferential node, or that of a bar oscillator, was 100 kc/s; whereas the limit of the latest rectangular plate type of sensible zero frequency temperature coefficient was 1,000 kc/s. It oscillated in a shear mode and was clamped in the nodal plane mounted in a partially evacuated holder, a double air gap being employed. Pentode drive and buffer stages were used and a number of independent 75-ohm outputs were available from a balanced transformer. Power was supplied from a stabilised floating battery.

Whereas the whole of the P.O. crystal requirements for frequency stabilising oscillators could be counted in hundreds, crystal-filter resonators for the full equipment of a single co-axial cable might exceed ten thousand. Mr. Gill referred to the crystal laboratory at Dollis Hill, to methods of selecting and grading the raw material, and to machines for speedier and more accurate cutting of crystals. The slicing of plates for frequencies greater than about 10,000 kc/s demanded a very high degree of skill. They were extremely fragile and for zero temperature coefficient at 20,000 kc/s the plate thickness might be only 0.12 in., yet a high degree of face parallelism was necessary. Plates for up to 25,000 kc/s had been made, but the commercial limit at the moment was considered to be 20,000 kc/s.

The P.O. provided the B.B.C. with quartz oscillators for frequency control in common-wave broadcasting. Subsequent tests had shown that for periods of one hour or more the frequency difference was less than one part in 10^9 and that the total separation was only six parts in 10^8, showing that rigid oscillators provided sufficient stability.

Transatlantic Telephony

The latter half of Mr. Gill's address was concerned with long-distance short-wave telephony, particularly the transatlantic service, which is the busiest long-distance link in the world. The main traffic was carried by four short-wave circuits and the long-wave circuit was not an adequate standby during periods of maximum sunspot disturbance, the next of which was due in 1939-40.

The transmitter power at present employed was approaching the economic limit and antenna directivity of the fixed type had probably been exploited to greatest useful extent. But single side band transmission had advantages, some of which were enumerated by Mr. Gill, who also described the double channel receiver used by the P.O. experimentally on the London-New York circuit. In addition, he discussed at some length "Musa" multiple steerable antennæ (see ELEC. REV., May 6th, 1938, p. 640) which were being erected for commercial reception at Cooling Marshes, near Rochester, in Kent, and at Manahawkin, New Jersey.

The British P.O. and American Telephone Co.'s stations were being designed for the same performance, but would differ to some extent in detail, the British array having 16 rhombic antennæ along the great circle path with a length of two miles and 656 ft. spacing between centres. The two initial receivers, each for two speech channels, would be mounted on standard racks forming 88 bays about 110 ft. long and 8 ft. high. Since the improvement expected (as compared with a simple receiver) was about 1,000, the complication seemed worth while, said Mr. Gill. Hitherto the total cost of receiving equipment had generally been much less than that of transmitting gear, but now that the two costs had become of the same order it was no longer possible to obtain improvements more cheaply at the receiving end, and further betterment must be sought at the transmitting end.

The Irish Telephone Service

TELEPHONE service in Eire was the subject of the inaugural address of Mr. J. W. O'Neill as chairman of the Irish Centre of the INSTITUTION OF ELECTRICAL ENGINEERS in Dublin on October 27th. He recalled the opening of the first commercial exchange in New Haven in 1878, the year before the first exchange in London, and the events that led up to the planning of a system for the country as a whole.

The design of any system depended on local conditions, said Mr. O'Neill, who outlined the particular requirements of Eire and the manner in which they were catered for. He pointed out that the service was State owned, but it was regarded as a commercial enterprise. Extensions were charged to capital account and the income from fees, rentals, &c., had to cover all operating and maintenance expenses, provide an adequate sum annually for depreciation and pay 5 per cent. interest on the outstanding capital. If, after that, a surplus remained, it was considered to be profit. If the full interest was not earned the deficiency was regarded as a loss. Since 1932 profits had exceeded losses.

The first automatic exchange was brought into service in 1927 and by the autumn of next year it was expected that 90 per cent. of the telephones within a 10-mile radius of College Green, Dublin, would be connected to automatic exchanges, or 60 per cent. of the telephones in the country. All subscribers' lines were cabled directly to the main exchanges, but if future conditions should render the establishment of satellite exchanges more economic, they could be introduced with the minimum of rearrangement. In the greater Dublin automatic network unit fee metering was adopted, since the preponderance of short-distance calls rendered multi-metering uneconomic. In the city of Cork an automatic system would be put in hand soon.

The distances between Dublin and the more important provincial centres were generally over 100 miles. The number of circuits required was comparatively small and there were few intermediate points of importance on the routes. The distances were too great to render it economical to provide high-grade circuits by heavy gauge open wires, and the number of circuits was too small to justify cable. Therefore a system of three-channel carrier current working on open wires had been adopted for the backbone trunk circuits.

In future carrier working might become economical for

distances less than sixty miles. The life of the amplifier valves was very long and such systems had immense reserves of power. To cope with the steadily growing cross-channel traffic, carrier working was being applied to submarine cables. Two new ones had been laid from Dublin to Wales, one in September, 1937, and the other in August, 1938.

These cables were of a novel type evolved within the last few years. They consisted of a central conductor covered by approximately ¼ in. of special waterproof low-capacity insulation, which in turn was surrounded by layers of copper tape forming the earth lead. The whole was served with an armouring of steel wires in the usual manner. These cables were designed to give the lowest possible loss at high frequencies, as they were to be the go and return conductors of a carrier system, at present being installed, which it was hoped would be available for service within two or three months. The system would provide sixteen channels at the outset, working on frequencies up to 60 kc/s, the band width for each telephone channel being 4 kc/s at the higher frequencies and at 3 kc/s at the lower.

The majority of trunk calls were incoming to Dublin and destined for automatic subscribers. A method of providing full dialling, and in addition full signalling, facilities was now being installed on all internal carrier circuits terminating in Dublin. It employed timed pulses at 600 and 750 cycles either together or separately.

Rural areas were served on a manual basis and an improved type of magneto telephone was being installed at the electrically more remote exchanges. The nature of the problem was indicated by the fact that of some 800 exchanges more than 600 had fewer than ten subscribers each.

Long-spark Phenomena

INTRIGUING demonstrations of the behaviour of long sparks, produced by means of a 600-kV impulse voltage generator, between variously shaped electrodes in air, in a glass vessel filled with distilled water and over the surface of a large glass insulator, preceded the discussion of Dr. T. E. Allibone's paper (to which reference was made last week) at the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 3rd.

Sir George Simpson opened the debate by agreeing that in very many cases a leader did blaze a trail for the main stroke. There was no doubt about that, but it was equally certain that that was not the complete explanation of the process. He exhibited a lantern slide showing what he described as negative brush discharge upwards from a tall building together with a positive downward discharge from a cloud. Another illustrated a stream of discharge moving for 20 miles horizontally before striking the ground, without branching and of the same intensity all the way along. Then there were "rocket" discharges and curiously meandering flashes, some of which he had himself seen, which were very difficult to explain by the leader theory. Physicists were grateful to commercial firms which undertook fundamental research of this kind.

Dr. W. M. Thornton said that perhaps the most interesting feature of this work was the time lag which existed in all spark discharges. Globular discharge had been produced at least once in a laboratory. Was it possible for such ball discharge to travel horizontally and so appear to form a line of discharge? Multiple strokes might be explained by their energy being dissipated too soon to permit the main stroke to be completed. Was there any evidence of a rotating field accompanying spark formation?

Lichtenberg Figures

Dr. E. H. Rayner referred to work done at the N.P.L., and suggested that certain kinds of Lichtenberg figures seemed to be more than usually valuable for conveying an idea of what did happen. There appeared to be a stream of electrons drawn from a positive point down to a plane earthed cathode.

Dr. W. Wilson indicated that more use could be made of Lichtenberg figures and klydonograph records, since such apparatus was more simple and docile than that needed for producing laboratory sparks and lightning. He would like to hear that induced lightning strokes were still considered to be possible, because they would account for so-called maloperation of protective gear. Opinions based on photographs of lightning strokes taken by people who were not expert photographers could be very misleading.

Dr. S. Whitehead read a discourse on a particular aspect of spark-over in relation to spacing, corona and the degree of symmetry and homogeneity of the field, as affecting the frequency (numerical) of positive and negative discharges.

Dr. J. L. Miller commented on the difference between physicists' conceptions and engineers' assumptions. The idea that the stepped form of leader stroke was due to cloud conditions seemed to be confirmed by the author's findings, and yet Prof. B. L. Goodlet had previously maintained that it was caused by earth conditions. Photographs of a spark gap between a sphere and plain earthed electrode showed that while the most intense discharge was at the sides, yet breakdown occurred vertically across the minimum gap, which indicated that there was still much more to be learned.

Mr. B. S. Cohen exhibited photographs of ionisation tracks on surface films on bakelite. They were somewhat similar to Lichtenberg figures and indicative of effects on the interior surfaces of insulators. Mr. E. O. Taylor showed klydonograph records and suggested that stepped leader strokes might be caused by voltage changes at the discharge electrodes. The insulating nature of clouds might prevent continuance of the main stroke. Mr. W. T. O'Dea said that ball lightning could possibly result from the persistence of pockets of horizontally ionised or ozonised gases.

Mr. J. E. Taylor exhibited a small instrument he had made in an attempt to prove that it was not possible for brush discharge to take place from earthed points, such as trees and buildings. He contended that a very strong field would be needed to cause sufficient ionisation.

Prof. J. T. MacGregor-Morris explained that he was probably the producer of the ball lightning at University College to which Dr. Thornton had referred. He was withdrawing a wire electrode from a tank of sulphuric acid and at the instant of contact break a ball of fire formed and floated along gently, finally vanishing with an extremely violent report. It was probably due to the production of a very heavy current at the surface of the liquid, but he had never been successful in repeating the phenomenon. Rotating camera photographs showed horizontal streaking when the light source was moving vertically. The spectroscope might assist in the study of why the luminosity of some parts of discharge persisted longer than that of other sections.

Dr. T. E. Allibone used the concluding part of his experimental demonstrations as a reply, in part, to the discussion. Brush discharge did take place from earthed objects, such as the masts of ships at sea and donkey's ears in Africa. In some of his photographs there was evidence of the incipient formation of ball lightning, at the point where a downward leader stroke met an upward flash, possibly due to violent recombination of electrons.

Cold Jointing Compound

DETAILS of a cold-pouring joint box compound and of a machine evolved for the routine spark testing of cables were given in the presidential address to the London Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS on November 1st, by Mr. W. C. Barry (of Henley's Research Department). He reviewed several instances of compound containers, heated above ground and when taken below bursting into flames on raising the lid. A cold compound he described consisted of a black pitch-like liquid of such consistency that it could be poured readily, and a hardening agent in the form of a paste. The two were mixed together just before the compound was required, the stirring being performed quietly and with a horizontal action to avoid introducing air bubbles. Once the paste was added it commenced immediately to thicken, and after an hour it became too viscous to fill a box satisfactorily. Due to the chemical action, a slight temperature rise might be noticed, but that was of no practical importance and no perceptible volume change occurred in setting. That was a very big advantage, as it eliminated the need for the topping-up process and ensured that there would be no voids or cleavage surfaces in the compound. The hardening action continued so that the flow ceased completely in a few hours, and in a day or two it was a fairly soft plastic solid. The flow and melting points were very similar indeed to those of typical pitch type compound. The hardening was progressive with time.

To test the ability of the new compound to prevent ingress of moisture, joints had been prepared with it and exposed for a year to severe weathering, to artificial changes of temperature and, in some cases, to complete immersion in water during the whole period. After those tests the joints still gave "Megger" readings of infinity, and the electrical breakdown value was satisfactory. Neither the dielectric resistance nor the breakdown strength of the compound was as great as that of the pitch types, but both were more than ample for the purpose. Some boxes were filled with the compound in collieries, and after about two years were still functioning without any trouble.

Whereas a hot-pouring compound tended to be chilled when it came into contact with the metal of the box and thus gave some risk of cavitation, that could not occur with the cold-pouring compound, which remained fluid for some time, setting gradually and uniformly throughout. Although in the main that was an advantage, there was the risk of leakage between the parts of the joint box before the compound had set, unless the surfaces were machined. To overcome that

difficulty, a plastic luting compound could be forced into the groove provided for the gasket normally employed with hot compounds.

The new edition of British Standard Specification No. 7, about to be issued, permitted the layer of pure rubber next to the conductor to be omitted, and had, quite rightly, abandoned classification by megohms in favour of the voltage of the circuit on which the cable was to be used. The insulation resistance test was relegated to its proper place, namely, as an indication to the manufacturer of the consistency of his product, and not to the purchaser as a criterion of quality. The same specification would almost certainly authorise a change which was steadily growing in the factories, namely, that spark testing might be used on certain sizes of cables and flexible cords, instead of a high-voltage test of 15 minutes after 12 hours' immersion in water.

Mr. Barry described a spark-testing apparatus arranged for use in a factory in a routine manner, which was due primarily to one of his colleagues, Mr. J. H. Savage, whose invention comprised the employment of a gas-filled valve as a detector, triggered by the high-frequency currents set up in a special circuit by the fault surge. The equipment was in commission for routine testing, the electrode chamber being at the top, while the transformer, valves and other apparatus, were conveniently housed beneath. The relay could be made to ring an alarm and switch off the motor winding the core through the machine. A condenser in the cable circuit limited the fault current and reduced the danger of shock. Metal rectifiers were used, so that the equipment was of the all-mains type and adjustment was limited to voltage variation to suit the different types of cable being tested, and grid adjustment of the valve to alter the sensitivity. Complete safety was assured by an interlocking system and the conductor was earthed. The circuit operated in a few micro-seconds and, although the cable was being tested at power frequency, it was not necessary for the high voltage to puncture a faulty piece completely.

Remote Control

THE principle and applications of ripple control of remote appliances on the "Actadis" system were outlined in a paper by Mr. H. Purslove Barker which was read before the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on November 1st.

In the subsequent discussion Mr. G. Tracey said that for many years designers had been doing their utmost to eliminate harmonics from all classes of generators, transformers, &c., and it might appear to be a reversal of that policy to inject deliberately what seemed to be an harmonic. He wondered what the effect of that would be upon certain pieces of apparatus in odd corners of the network; complex and delicate instruments used for testing, research, &c., might suffer damage as the result of the signal frequencies. He also asked whether circuit-breakers controlling condensers for power factor correction had been tripped as the result of the increased current, and whether wireless sets had been affected adversely. Electro-medical apparatus employed high-frequency circuits which might be very sensitive to external high-frequency signal currents, and local resonance due perhaps to cable capacity and load conditions at a particular place and time might possibly cause cable joint failures.

Mr. Barker replied that a ripple signal lasted for only a very few seconds per day and he could not picture the possibility of interference or that a ripple of one-tenth of a volt-ampere could do harm. In reply to Mr. D. E. Lambert he said that there was no proper comparison of costs or other things. There were not many British networks requiring machines larger than 30 kVA.

Weaknesses of Vibrating Reeds

Mr. G. M. Sichel said that, although he imagined ripple control was not of universal application, its applicability depending largely on the arrangement of the distribution system, it seemed that it could be of very great advantage in certain cases. Had the author knowledge of cases in which all the relays had been operated as the result of an arcing fault or a lightning stroke? Vibrating reed relays could perform functions they were not intended to perform, due to the method of mounting them on the supporting panels, or to the natural periods of vibration of the building.

Mr. A. W. Connor said that vibrating reeds suffered fatigue with age, and after three or four years would read half a cycle high.

Mr. Barker said that the current consumption of the relays was 0.2 VA at 50 cycles. In reply to Mr. A. E. Andrews and others he recalled that about 18 months ago he had said that about 10,000 kVA was about the size of system for which ripple control became attractive; but a fortnight later he had been instructed to install a system in an installation with a maximum demand of 3,500 kVA. The dividing line depended on the purpose of the equipment. In the case of a small undertaking which needed to economise in maximum demand and was interested in load control, and had also a fairly large amount of street lighting, he supposed that 1,000 or 2,000 kW represented the dividing line. If street lighting were the only criterion, the dividing line would be higher. Transmitters cost anything from £3,000 upwards. A relay cost £3 10s. or less, depending on whether it was enclosed in a moisture-proof case and whether or not it must have fuses. It was much the same as a synchronous motor time switch of good class. In some cases as many as 10,000 relays were being operated by a transmitter costing £3,000, or £0.3 per relay.

Patents and Plastics

INVENTIONS and patents were the theme of the presidential address of Sir James Swinburne (chairman of Bakelite, Ltd.) to the INSTITUTE OF THE PLASTICS INDUSTRY in London on October 25th.

Sir James said he thought that inventions were usually the work of men under forty and often were the products of those without scientific training. He attributed this apparent anomaly to the likelihood of the technical man to allow his thought to be constrained to narrow grooves. Specialisation was against the home inventor. The day of the lone worker was past and progress now was usually the result of co-ordinated efforts of large research departments. When the independent worker approached a commercial concern with an invention he would meet with opposition from the technical representative of the company inspired by the human instinct of self-preservation, since the device submitted was something which the staff man felt that he himself ought to have thought of. The executive, to be a good business man, should not be too clever and it was usually a mistake to allow the inventor business control.

Sir James felt that the cost of patents was too high and that the legal expense entailed in fighting an infringement favoured the large company. The appeal system gave rise to anomalies. Thus, the first judge might decide against a patentee, the appeal judges might agree with him, and, finally, three out of five in the House of Lords might uphold the patentee's claim. One then had the curious position of three judges over-ruling six.

The presentation of the company's film entitled "Bakelite, the material of Infinite Uses," before the Birmingham and Midlands Section of the Institute was prefaced by a short talk by Mr. C. C. Last, who outlined the properties of a new moulding material which had been specially produced to withstand the effects of chemicals and prolonged immersion in water, suitable for the production of moulded water softeners. Another development was the production of a phenolic moulding powder which was completely free from odour. Blister-proof veneers were resistant to heat, moisture, fruit juices and alcohol, while the industrial grades were employed for gear wheels, bearings, &c., as well as many electrical applications. Among synthetic resins for paints and varnishes were new primer bases capable of drying off completely within twenty minutes, as compared with the two days' delay necessitated by red lead primers.

Stand-by Plant

THE operating conditions of thermal power plant for peak-load and emergency service are discussed in the paper by Mr. H. S. Hvistendahl (Brown, Boveri & Co., Switzerland) which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 10th.

The paper commences by distinguishing between the different classes of service to be performed by stand-by plant, and subsequently deals with the choice of fuel and the respective fields of application of oil-engine and steam plant. Only the last-mentioned, to which most of the paper is devoted, is considered to be suitable for large outputs. Three short concluding sections deal with instantaneous and automatic stand-by plant, together with various recent installations of special interest.

The use of coal may be seriously considered for plant with a certain minimum number of operating hours, or use-factor. The latter is defined as the ratio of the actual kWh sent out in a year to that theoretically possible with uninterrupted operation at continuous maximum rating. It is inadvisable to call this quantity the load factor, which denotes the ratio of the average to the maximum kW demand.

The critical use-factor depends on the relative costs of coal and oil, and on the extra charges associated with the provision, operation, and maintenance of coal-handling, storage, and pulverising equipment and ash-disposal plant. For European conditions the critical plant use-factor is usually between 7 and 10 per cent., equivalent to about 600 to 900 hours' operation per annum at maximum continuous output, or 1,200 to 1,800 hours per annum at an average load of 50 per cent. of maximum

continuous rating. For oil-producing countries, and ports with facilities for discharging complete tanker loads, the critical value may be much higher, oil not infrequently displacing coal in base-load stations. Moreover, it should not be forgotten that coal cannot be stored without waste, the chief causes of which are loss of volatile constituents, scattering by wind and rain, spontaneous combustion and pilfering.

Large Diesel Sets

Diesel-engine generating sets have been built with maximum rated outputs up to 15,000 kW (Oersted station, Copenhagen), but their high price per kilowatt installed, which for capacities of this order is half as much again as that of modern oil-burning steam stations, together with the extra costs of lubrication and of higher-grade fuel oils—only partly compensated by their higher thermal efficiency—restricts their economical application to stations of less than 3,000 kW output, whereas the size of stand-by plant in which electricity supply authorities are chiefly interested is of the order of 10,000 to 30,000 kW.

Various ways of bringing steam turbines of this size from cold up to full speed in about five minutes, and alternative means of furnishing and minimising the initial power needed to start auxiliaries in emergencies, are outlined, types of quick-steaming boilers being mentioned also.

Forthcoming Events

Institution of Electrical Engineers (*Meter and Instrument Section*).—Friday, November 18th. Holborn Restaurant, London, W.C.1. 6.45 for 7 p.m. Section dinner.

North-Eastern Centre.—Monday, November 14th. The Newe House, Pilgrim Street, Newcastle-on-Tyne. 6.15 p.m. "Thermal Power Plants for Peak Load and Emergency Service," by Mr. H. S. Hvistendahl.

North-Western Centre.—Tuesday, November 15th. Engineers' Club, Manchester, 7.15 p.m. "The Moving-coil Voltage Regulator," by Mr. E. T. Norris.

East Midland Sub-Centre.—Tuesday, November 15th. Electricity Showroom, Derby, 6.45 p.m. "The Trend of Design of Electric Locomotives," by Mr. C. E. Fairburn.

Northern Ireland Sub-Centre.—Tuesday, November 15th. 9, Wellington Place, Belfast. 6.30 p.m. "Electric Heating for Merchant Ships," by Mr. H. C. MacEwan.

Devon and Cornwall Sub-Centre.—Wednesday, November 16th. University College of the South-West, Exeter. 7 p.m. "The Moving-coil Voltage Regulator," by Mr. E. T. Norris.

Sheffield Sub-Centre.—Thursday, November 17th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Electric Furnaces," by Mr. H. A. Wainwright.

Physical Society.—Friday, November 11th. Imperial College of Science and Technology, South Kensington, S.W.7. 5.15 p.m. Short papers.

Junior Institution of Engineers.—Friday, November 11th. 39, Victoria Street, S.W.1. 7.30 p.m. Annual general meeting. Friday, November 18th. 39, Victoria Street, S.W.1. 7.30 p.m. "Industrial Electric Heat Treatment," by Mr. C. E. Ward.

Association of Mining Electrical Engineers (*North of England Branch*).—Saturday, November 12th. "Intrinsically Safe Circuits," by Mr. W. Britton.

West of Scotland Branch.—Saturday, November 12th. Royal Technical College, Glasgow. "Small Electrostatic Condensers," by Mr. R. Wilson.

Illuminating Engineering Society (*Industrial Lighting Section*).—Monday, November 14th. Home Office Industrial Museum, Horseferry Road, S.W.1. "Electric Discharge Lamps and their Applications to Industrial Lighting," by Mr. C. A. Hughes.

Commercial Lighting Section.—Wednesday, November 16th. 2, Savoy Hill, W.C.2. Discussion on "Combined Tungsten and Electric Discharge Lighting of Commercial Premises," to be opened by Mr. W. R. Stevens.

Public Health Services Congress and Exhibition (1938).—Monday, November 14th, to Saturday, November 19th. Royal Agricultural Hall, London, N.

Association of Supervising Electrical Engineers.—Tuesday, November 15th. 2, Savoy Hill, W.C.2. 7.15 p.m. "Modern Electric Discharge Lamps and their Applications," by W. J. Jones.

Electrical Power Engineers' Association (*London Local Group*).—Tuesday, November 15th. Caxton Hall, Westminster, S.W.1. 7.15 p.m. "The Commissioning of a Modern Power Station," by Mr. C. W. A. Priest.

Belfast Association of Engineers.—Wednesday, November 16th. Central Hall, Municipal College of Technology, Belfast. 7.30 p.m. "Reduction in Works Costs by Power Factor Improvement," by Mr. P. Conly.

British Electrical and Allied Manufacturers' Association.—Thursday, November 17th. Grosvenor House, Park Lane, W. 7 for 7.30 p.m. Annual dinner.

British Institute of Radiology.—Thursday, November 17th. Reid-Knox Hall, 32, Welbeck Street, W.1. 8 p.m. "Quality of High-voltage Radiations in Tissues," by Mr. J. Clarkson.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 18th. Mining Institute, Neville Hall, Newcastle-on-Tyne. 6 p.m. "The Utilisation of Steam for Power and Heating in Industry," by Messrs. G. L. E. Metz, C. L. G. Hyde, and J. S. Belcher.

Correspondence

E.I.B.A.'s Armistice Day Appeal

MAY I ask that those of your readers who, on November 11th each year, make a gift to help the many who are still suffering severely from the effects of the World War, will send at least something to the Electrical Industries Benevolent Association, which is looking after a number of men and women whose troubles arose out of those dread four years of 1914-1918.

The passing of the recent crisis emphasises that there is much for which we can be thankful; I ask that this gratitude should be expressed by sending an extra gift, on this twentieth anniversary, to help those whose troubles were not over by November 11th, 1918. J. N. STEPHENS.
Chairman, E.I.B.A.

6, Southampton Street, W.C.1, *November 3rd.*

Cooking and Voltage

The attitude of certain public utility authorities towards their customers passes comprehension. For the past eighteen months I have resided in a semi-urban area within two miles of the main distributing station. I have been anxious to use electricity for all domestic purposes, but for cooking I have encountered endless difficulties.

After two and a half years' successful use of a small cooker in another area under the same authority I moved to my present house. Complaints of inefficient cooking were countered by hints that my wife was incompetent. Admittedly this was wrapped up politely, but suggestions that the cooker might be at fault were never entertained.

Through the courtesy of a friend I obtained a series of readings with a reliable voltmeter and have established the fact that at the domestic peak hours (this is exclusively a residential area) there is a drop of up to 30 V on the 200-V supply.

I appreciate the difficulty of planiing in areas around London where building development is rapid, but it should not be necessary for the consumer to trace the source of inefficiency.

To-day the position is that the defect is to be remedied by a voltage step-up at the area sub-station. The effect of this action on the efficiency of domestic appliances remains to be seen, but I trust that it may be possible for me to continue to use this very convenient source of power.

Woking, *November 8th.* I. W. RHYS.

Cheapness or Reliability?

In the account of the address of the chairman of the I.E.E. North-Western Centre given in your issue of October 28th, Mr. Fennell is reported to have said that electric cookers are too costly. It would be interesting to know what he would consider a fair price, as present prices of electric cookers seem to many engaged on the practical side of the trade to compare most favourably with coal, gas or oil cookers, quite apart from the value of their superior performance and cleanliness. If this were not so, would electric cooking have its present popularity as shown by the great increase in the numbers installed in recent years?

Cheapness does not pay; this applies especially to apparatus offered for sale by certain stores which no reputable contractor would install. Tradesmen who know their job will, in the interests of "safety first," use only first-class materials supplied by reputable firms rather than consider cheapness first.

Kingstanding, *November 2nd.* R. WALL.

The I.M.E.A. Convention

Although mention is made in the I.M.E.A. *Journal* of the change of venue of the Convention from Llandudno to Harrogate, no reasons are given for the sudden change. It has been rumoured that Llandudno is unable to cater for so large a number of delegates. Perhaps not if hotels are all that matter, but surely Llandudno, Rhos-on-Sea and Colwyn Bay have ample accommodation, and it is not everybody who likes to be plunged into a first-class hotel for one week. Surely, if the Convention is reaching such alarming proportions that it cannot be accommodated in a place like Llandudno it is high time that it was confined to delegates, instead of doubling the quantity of people attending through the presence of ladies and many manufacturers' representatives.

Has not there been some other influence at work to change the venue? One really wonders what is wrong with the Lancashire seaside resorts. However, the Yorkshiremen in particular will no doubt welcome their fellow countrymen in great style when they take the waters at Harrogate.

November 7th. DELEGATE 9999.

[In Mr. J. Steele's letter on "Motor or Trolley-buses?" in our last issue the capital cost of a trolley-bus was given as £2,000; the figure should have been £2,200.—EDS., ELEC. REV.]

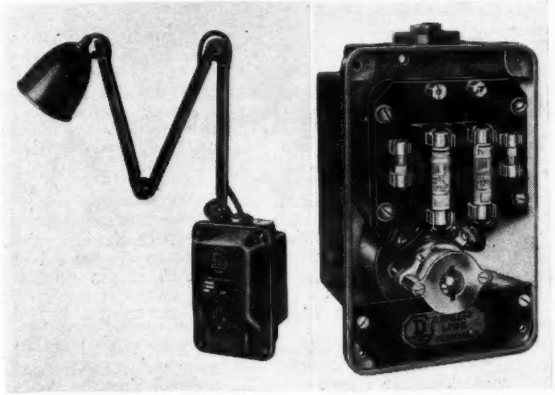
New Electrical Products

A review of equipment recently marketed

Low Voltage Lighting Unit

THE DONOVAN ELECTRICAL CO., LTD., Stetchford, Birmingham, 9, has introduced a low-voltage unit intended principally for machine and tool lighting. The primary can be any voltage up to 550 V, AC, and the secondary, 12, 25 or 50 V.

The Type 850 iron-clad low-voltage lighting unit consists of a robust cast iron case with screw-on lid enclosing a 230-V or 400-V primary transformer with a 12-, 25- or 50-V secondary having an output of 48 W, 50 cycles. A 600-V rotary double-pole switch serves to connect the transformer to the supply and is provided with an interlock to ensure that the lid can



The Donovan low-voltage lighting unit

only be removed with the switch in the "off" position. The transformer primary winding is protected by two high-rupturing-capacity fuse cartridges, and two secondary fuse cartridges are fitted for the lamp circuit, the mid-point of the secondary being connected to the earthing terminal.

The whole assembly is arranged so that no live metal is exposed when the lid of the starter is removed, the input terminal being shielded. The transformer is of high-grade construction. The windings instead of being of only enamel-covered wire are also insulated by a layer of silk. The windings are separated by a metal barrier connected to the earthing terminal.

A Radial Reflector Fire

In the latest radial radiant reflector fire of the LIMIT ENGINEERING CO., LTD., 15, Windsor Street, London, N.1, wide-angle radiation from a single reflector is obtained by means of a curved parabolic reflector and a curved element as in previous models. This design

The new "Limit" portable fire

gives extensive heat distribution for a small loading. The new portable model has been produced to meet a demand for a light yet sturdy fire, and whereas the other "Limit" fires have their vertical angle of reflection fixed for maximum distribution when standing against a wall or fireplace the new model is adjustable and swivels vertically on its base so that it can be stood anywhere or be hung on the wall.

Geared Motors

A compact new single reduction geared motor, built on the same lines as the larger "Neco" geared motors, has been introduced by the NORMAND ELECTRICAL CO., LTD., North Street, Clapham Common, London, S.W.4. The motor speed

The new "Neco" geared motor

is 1,400 RPM, but the reduction gear gives final speeds of 1,750 and 350 RPM at outputs of ¼, ⅓ and ½ HP. Standard speeds are 1,750 and 1,145 RPM, which is of interest to users of American machinery designed for 60-cycle motors running at those speeds.

A Fan Heater

A fan heater of unusual appearance has been developed by the PHILCO RADIO & TELEVISION CO. OF GREAT BRITAIN, LTD., Perivale, Greenford, Middlesex, for operation on AC at 200/250 V. A fan is situated behind a 1,500 W element and a gauze screen prevents contact with either. A lamp gives a warm fire-like glow. The heater can

The "Philco" fan heater

be switched off for summer use. The shape of the moulded casing is attractive, being similar to a radio receiver.

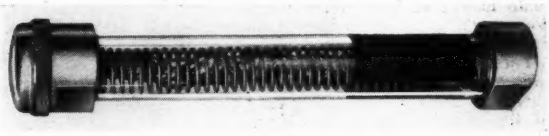
New Cables

For urgent repair work BRITISH INSULATED CABLES, LTD., Prescot, can supply cotton-covered conductors impregnated with black varnish. The use of this wire obviates stoving after re-winding.

For interior work where cables with self-extinguishing servings are required the company is now applying a finish consisting of two hessian tapes impregnated with a patented flame-resisting paint. For situations where appearances are important a further impregnated cotton tape can be added. As an alternative the cables can be braided and painted with the special paint. This finish has a very good appearance.

Rewirable Liquid Fuses

The range of "Quenchol" rewirable liquid fuses manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London W.C.2, has been extended by the addition of two new series, types III and IV, having maximum fusing



A "Quenchol" high-voltage liquid fuse

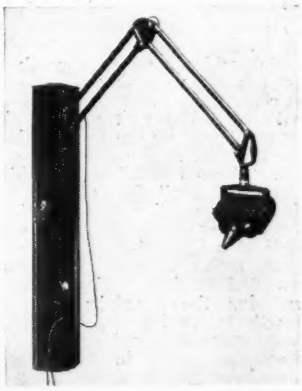
currents of 100 A and 200 A. These are available for voltages up to 88,000 and 110,000 respectively, and have rupturing capacities up to 500,000 kVA.

All G.E.C. liquid fuses are interchangeable with other liquid fuses of the same rating and both rewiring and refilling can be performed by the user at low cost.

Dental X-rays

Provided adequate output is obtainable without rendering the size unwieldy, the combination in a single housing of an X-ray tube together with its anode and filament transformers is most attractive for dental radiology, because such an assembly obviates the necessity for high voltage cables and makes correct positioning easy, a simple low-voltage connection to AC mains being all that is needed.

The tube-head of the "Kingsway" outfit of WATSON & SONS (ELECTRO-MEDICAL), LTD., 43, Parker Street, Kingsway, London, W.C.2, is designed in this manner. Its rating is 10 mA at 60 kV, which is relatively high for a shockproof outfit of such modest dimensions. The tube-head is mounted in a



"Kingsway" X-ray set

trunnion and is free to rotate through 360 and 277 degrees respectively on vertical and horizontal axes. A clearly calibrated "angulating" scale is provided at each end. The transformer has both dry and oil insulation, the latter serving mainly as a cooling medium. Exposures equivalent to 3,000 intra-oral radiographs per day, for 20 days, have been made without overheating. Beside photographs visual-screen examinations can be made without overloading the set. The input is 5 A at 230 V and it is claimed that line-voltage fluctuations of as much as plus or minus 10 per cent. do not appreciably affect the kV output, which, to avoid complication, has been made non-variable.

D'

Control is by a push-button time switch on a long flexible lead. Its dial is divided into quarter seconds and the pointer is unusual in that it can be turned backward should it be accidentally set for too long an exposure. A pilot lamp indicates when the tube-head is energised, but voltage is not applied to the tube until the hand switch is operated. The outfit is available in two models, a mobile pedestal or wall bracket of original design, both adjustable and self sustaining without springs.

Domestic Cooker

On December 1st the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is to introduce a completely new cooker (D.C. 100) of artistic modern design eliminating as much as possible protruding parts and sharp edges. Bar type handles and specially shaped switch knobs in chromium and black, red or green are fitted and the general finish is mottled grey, green or white porcelain enamel.

The G.E.C. "DC 100" cooker

There is a shallow splash-plate at the back of the hob which contains two plates, a dual-purpose boiler-griller measuring 8 in. by 10 in. with a loading of 2,000 W and an 8 in. diameter circular hotplate loaded at 1,800 W, for which may be substituted the company's standard radiant boiling plate (1,800 W) or an extra fast 2,250 W enclosed plate.

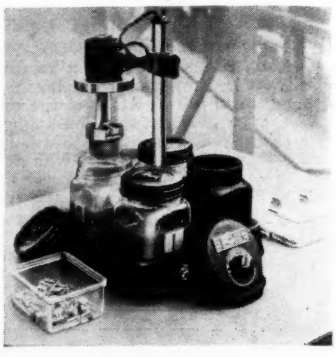
The oven takes the form of a porcelain enamelled one-piece lining which can be removed for cleaning at the sink. The shelf runners are particularly easy to clean, being pressed out of the sides of the oven lining, and the heating elements (loading 2,250 W) are placed in both the sides and bottom of the oven. Thermostatic control giving sixteen heats is normally provided, but when this is not fitted there is a thermometer in the door. A pilot light is incorporated.

The overall dimensions of the cooker are 21½ in. wide by 20¼ in. deep by 41¼ in. high, the net oven cooking space being 12 in. wide by 13½ in. deep by 13 in. high.

A Machine for Washing Meter Parts

The meter departments of many electricity supply undertakings will in future have to recondition a greatly increased number of meters per annum in order to comply with the Electricity Supply (Meters) Act, 1936. The requirement that no meter installed before "the appointed day" shall remain in service for more than ten years without certification implies cleaning before testing.

Hand-cleaning of the small parts of a meter is a slow and tedious job, besides being expensive. A quicker and more efficient and economical method of reconditioning is to employ a small electrically driven machine designed to clean batches of such working parts as wheels, jewels and pivots thoroughly in a few minutes without brushing or pegging. The finish is claimed to be superior to that of high-class handwork.



The machine for cleaning parts of meters

The machine, only 18 in. high, and occupying about a square foot of bench space, consists principally of a motor-driven basket which can be lowered, in turn, into three glass vessels containing cleaning and rinsing fluids, and then into a drying chamber. The motor, which is clamped in a vertical position to a stout pillar, is of the universal AC or DC pattern with ball-bearings, and an extension to the shaft carries the monel metal mesh basket into which the parts to be cleaned are placed. The basket is approximately 2.25 in. in diameter and 1.5 in. deep, with a separate mesh lid; it is easily and quickly attached to the motor shaft by means of a bayonet pattern fixing device.

The pillar supporting the motor rises from the middle of a rectangular cast-metal base; in this are spaces for three glass jars containing the washing liquids, and a drying chamber of similar dimensions containing a small electric heating element. On the front of the metal stand is a large boss carrying two tumbler switches, one controlling the motor and the other the heating element. Between them is a rheostat for regulating the speed of the motor. Moulded bakelite screw-on covers seal the jars when the machine is not in use.

Attached to the motor shaft above the basket is a three-bladed propeller designed to force the cleaning liquid through the basket and fixed metal blades which dip into the body of the liquid. By breaking up the flow they compel agitation which contributes to the cleaning operation. When the basket is raised the motor should be run fast for a few seconds to spin off the loose liquid before insertion into the rinsing fluid. It is important that this spinning-off process should be performed conscientiously. Actually he whole operation takes about five minutes.

Specially compounded liquids are supplied by the makers of the machine; being non-inflammable and non-corrosive they will not harm even the most delicate parts. They do not damage, for example, the paint usually employed on register dials. Actual experience in a large meter factory shows that one charge (about a pint) of cleaning liquid can be used for 20 to 30 hours' running, while the rinsing liquid is capable of 80 to 100 hours' use.

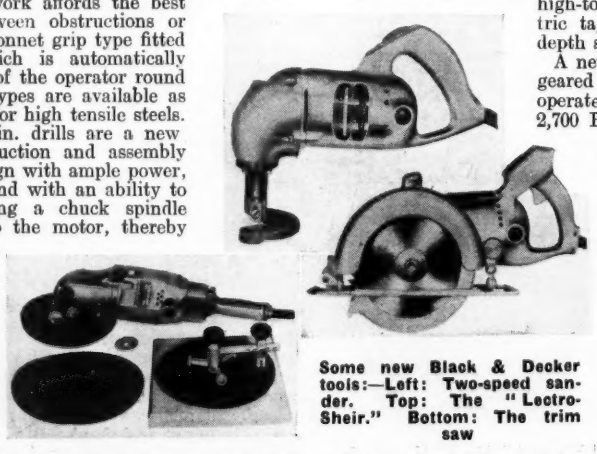
The motor takes approximately 25 W and the heater 60 W. The suppliers are the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.

Portable Electric Tools

SEVERAL new portable tools have recently been placed on the market by BLACK & DECKER, LTD., Slough, Bucks. A ⅜ in. drill is made normally with a side handle and trigger switch which for general work affords the best grip, but for working between obstructions or in close corners there is a bonnet grip type fitted with a paddle switch which is automatically pushed "on" by the hand of the operator round the field case. The same types are available as ¼-in. "Aero-Special" drills for high tensile steels.

The "Shorty" ⅜- and ¼-in. drills are a new design for small unit production and assembly work, being of compact design with ample power, of light weight (3¼-3¾ lb.) and with an ability to work round corners, having a chuck spindle mounted at right angles to the motor, thereby reducing the working length to 4½ in. Spiral bevel gears are used and deep vents cast in the gear head provide a free passage of air for motor cooling. The tapered end of the head projects over the chuck, affording protection for the operator.

The "Torsimeter" model is provided with a clutch arrangement for giving the correct amount of torque for each job, and has now been made available in the paddle switch style and also with a side handle. Another newcomer is a right-angle adjustable screwdriver and wrench, a right angle adjustable nut runner and a nut runner for low-speed, high-torque work. There is also an electric tapper with a floating chuck and depth stop.



Some new Black & Decker tools:—Left: Two-speed sander. Top: The "Lectro-Sheir." Bottom: The trim saw

A new 7-in. or 9-in. portable sander is geared so that the spindle can be operated at 4,200 RPM for the 7-in. and 2,700 RPM for the 9-in. disc. A combination sander and polisher is also available.

In the "Lectro-Shear" for 18 and 16 gauge the shearing action is accomplished by the rapid reciprocating action of a vertical blade against a stationary horizontal blade set in a special shoe which indicates the correct cutting angle.

In a new line of saws power is transmitted through worm gears, a rotary blade giving a maximum depth of cut of 2⅜ in. (vertical). The table can be tilted for bevel cutting at an angle of up to 45 deg. There is also a light trim saw which is designed on the same lines.

Small Motor Manufacture

Recent extensions at a Birmingham factory

WITH the recent completion of a new two-storey block at its Warwick Road, Tyseley, Birmingham, factory, Klaxon, Ltd., has increased by 65 per cent. the floor area available for the manufacture of its electrical products, the size of the works to-day being about 33,000 sq. ft.

The course in which this company's interests has developed is a remarkable one. Starting business as the manufacturer of the original Klaxon hand-operated motor horns, the company soon introduced electrically actuated models. The production of the electric motors required for these led to what, to-day, represents by far the largest part of the company's activities, the manufacture of fractional horse-power and geared electric motors for all purposes. A still more recent development is the making of windscreen wipers in sizes from the 8 in. long units for tanks to the 15 in. models for railway engines.

To avoid interference with production, occupation of the new building is being carried out in stages. The first floor has already been taken over by the winding shop and has been laid out on a well-planned flow system. Raw materials brought up from the stores by lift go to one of two production lines, one of which deals with stators and fields and the other with armatures.

Transporter conveyors, running the whole length of the production lines, carry the wound and assembled components to the end of the shop where they are stove enamelled and impregnated before being turned, ground and, in the case of the armatures, balanced. Tests are carried out at frequent stages throughout manufacture and every machine on completion undergoes a torque test.

The ground floor of the new building is intended mainly for assembly, testing and despatch, and three separate lines of flow will deal with motors, horns and wipers respectively. In one corner there is up-to-date plant for cleaning, degreasing, stove enamelling, plating and polishing, while adjoining them is a separate department where bakelite mouldings for commutator and terminal blocks, &c., are made. Special soundproof rooms are provided for testing motors as well as sirens, noise also being reduced by the motor-generators, &c., required for testing being installed in the basement.

The new extensions will permit reorganisation and expansion of the other departments housed in the old portion of the factory and the opportunity is being taken to modernise machinery. Among the new apparatus for gear making we noticed a battery of six Ward light capstan machines, two high-speed precision tools, a grinder, seven gear cutters, a Fellows gear shaper and a Pfauter "Mikron" gear hobber. Other new equipment includes an electric welder which enables the shells of the stators to be seam-welded on.

Although the company, of course, manufactures many standard articles in large quantities, it is to deal with comparatively small batches of equipment that production, as a whole, is organised. Any type of motor from 1/500 to $\frac{5}{8}$ HP, one-, two- or three-phase AC, universal or DC can be supplied, and a speciality is made of geared motors, which now in fact are said to represent between 60 and 70 per cent. of the total output of motors from the works.

No speed is too slow and units have been supplied with a reduction of two million to one and giving only one revolution a week! As Mr. E. T. Cook, one of the directors, told us, the company does not sell motors—it sells torque. A considerable amount of work is done in supplying electric motors to manufacturers of gears, and the company informed us during our visit that there has been an increasing demand recently for constant-speed motors.

[*Elec. Rev. photos.*

A general view of the winding shop at the new addition to the Klaxon factory at Birmingham. A close-up showing the coils being fixed to one of the largest stators made there

Electricity in Ships

THE annual report of Lloyd's Register of Shipping indicates a serious falling off in orders placed for new tonnage. During the year ended June, 1938, plans of 365 ships approved by the Society represented only 51 per cent. of the high total of the previous year. The numbers of electrically propelled vessels recorded in the Society's register book for the year 1938-39 are 41 turbo-electric of 468,583 tons, a reduction of one or 14,567 tons; and 69 Diesel-electric ships of 176,407 tons, an increase of seven or 47,170 tons.

During the period under review the motor vessel *Patricia*, 1,116 tons, built by Smith's Dock Co., Ltd., Middlesbrough, for the Corporation of Trinity House, and fitted with Diesel-electric equipment built under the Society's inspection, completed her trials successfully and is understood to be giving satisfactory service. Two twin-screw passenger vessels are at present under construction for the Russian Government in Amsterdam, in which turbo-electric equipment, supplied by Groeneveld van der Poll & Co. and the Allmanna Svenska Elektriska, Aktiebolaget, under the Society's inspection, will be installed.

An important development has recently taken place by the introduction of the electro-magnetic slip coupling for use in geared motor ships between the Diesel engines and the gears. The details of this entirely new device have engaged special attention, and several vessels have been fitted with such couplings built under survey.

The use of electricity on board ship, both in connection with motive power and for auxiliary services, has increased to a remarkable degree and is now a most important feature of the modern vessel. It has considerably extended the Society's staff of electrical engineer surveyors. There are now ten such surveyors stationed in this country, covering all the main building and surveying ports and manufacturing districts. During the year an electrical engineer surveyor has been appointed to Rotterdam to supervise the construction of electrical equipment in Holland, and he will be available for duties in neighbouring countries.

The use of electric welding continues to increase and its employment in the construction of lower decks, oil fuel bunkers, etc., has become a standard practice in several yards. A large passenger vessel at present being built has all decks and the topsides welded, and in another all the decks, which are of high elastic limit steel, are being welded. A number of large oil-carrying vessels are at present under construction in which the hull "in way" of the oil spaces is entirely welded, and in many others welding is used for the internal structure. The Society's surveyors have witnessed tests carried out with large gauge rods. Experimental work on the welding of plates without "veeing" has also been supervised, and the Committee has approved this method for use in classed ships under certain conditions.

The number of electrodes included in the Committee's approved list has reached the total of 172, of which 129 have been approved as complying with the special requirements for use in parts of primary importance in the structure of a vessel. In addition to the automatic electric arc process, which was included in the last issue of the Committee's list an automatic carbon arc welding process has now been approved and is being used in the construction in the United States of two vessels which are intended to be classed.

Manufacturers and Wholesalers. By J. Whitehead

While insisting on their rights, wholesalers must realise that they have duties both to their customers and to the manufacturers of the goods which they supply.

DIRECT buying by certain consumers from the manufacturer and the consequent desire on the part of these consumers to ignore the advantages offered to them by the wholesaler and factor have resulted in a most serious position being created for the manufacturer. Whenever there has been a trade depression manufacturers, through fierce competition, have had direct selling thrust upon them at prices which they have found unprofitable in spite of the fact that a fair margin was borne by the consumer to cover the extra expenses of direct selling in large and small quantities. The orders received from wholesalers diminished in volume, but to maintain their wholesaler connections until such time as the impending reversion took place when trade improved manufacturers in most cases allowed the regular wholesaler discount even for comparatively small consignments.

The position now is that certain wholesalers and factors say to themselves, "Why should we invest in a stock of materials when we can send our orders as we receive them to the manufacturer?" Worse still, the same wholesalers and factors will send in four or five small orders with instructions to the manufacturer to deliver them direct to their customers, little realising that it costs the manufacturer just as much in packing and handling charges to execute small orders as large ones.

Manufacturers to-day are greatly concerned at this tendency and wholesalers and factors cannot grumble when the manufacturer insists upon their doing their fair share and thus prove their right to full wholesalers' discounts. The day of the order taker has fortunately passed and the manufacturer is right in insisting upon the co-operation of the wholesaler to effect proper distribution of his goods. There are many definitions of the legitimate electrical wholesaler and factor, but unfortunately none of these meets the full requirements of every manufacturer. This lack of agreement on the subject of legitimate wholesalers and factors has led to some bickering and yet the manufacturer must use his own judgment in choosing the channels through which users of his materials can be most advantageously and economically served.

Distributors' Qualifications

The essential qualifications of distributors are:

1. They must hold a reasonable stock of the manufacturer's goods and also stocks of other closely related lines of other manufacturers.
2. They must have representatives constantly engaged in soliciting orders for these goods.
3. They must co-operate with the manufacturer's "missionary" men in allowing them to discuss with their customers technicalities not expected from the wholesalers' own salesmen.
4. They must order from the manufacturer in minimum quantities sufficient to entitle them to wholesalers' discounts and otherwise justify their claims for preferential prices in consideration of the assistance which they give to the manufacturer.

The *bonâ fide* electrical wholesaler and factor who acts in his true capacity is in a stronger position to-day than he has been for many years. More and more large manufacturers who have had experience of direct selling are turning to the wholesaler as the best and most economical outlet for their goods. More and more buyers are realising their mistake in ignoring the wholesaler. There is urgent need, however, for manufacturers to examine their sales policies and to discourage the type of wholesaler and factor who will not adhere to their terms and conditions. Providing these are reasonable, which they usually are, the manufacturers will be only too ready to assume full responsibility for their fair share of the distribution function.

By diligently and conscientiously soliciting orders by personal contact and taking the fullest advantage of the sales propaganda provided by the manufacturer the *bonâ fide* electrical wholesaler can create for himself a position of indispensability in the industry. By his actions he can give the lie to any questioning of his status and thus take a firm stand in the elimination of undesirable distribution practices by interlopers in the trade who cannot by any stretch of imagination be classified as legitimate wholesalers and factors. He can with advantage set himself out for a long overdue campaign of education amongst all those users of electrical accessories in his territory, proving to them the many advantages and savings he is able to effect for them in his position as representative, advisor, stockist and distributor for numerous reputable manufacturers.

Salesmen Must be Trained

Let him train his salesmen, let him also take advantage of the manufacturers' offer to teach his salesmen technicalities, but above all let those salesmen go out and make business. Electrical development and expansion everywhere have created an opening which should be enjoyed to the full by every legitimate electrical wholesaler and factor, but it is imperative that stocks shall be so built up as to serve properly the demands of the trade, otherwise their customers will transfer their orders to the supplier who offers them the advantages and conveniences of prompt supplies. Manufacturers commit themselves to a policy of wholesaler co-operation for the express purpose of distributing their goods to the best advantage, not for the wholesalers' sake. They do it because they know by a careful checking of their own distribution costs that if they sell to the wholesaler in bulk the wholesaler with his costs of distribution spread over many lines can more efficiently distribute those goods at selling prices much lower than the manufacturers could afford to do.

The wholesaler must not forget, however, that the manufacturer's prices are based on minimum bulk quantities and that orders for smaller lots obviously increase the manufacturer's costs and absorb his profits. The many branded lines which are sold through wholesalers and factors have fixed resale prices and in consequence any deviation from the normal method of distribution is bound to result in the loss of the manufacturer's profits. An appeal to the wholesaler to perform his proper function and an appeal to manufacturers with wholesaler policies to insist on the wholesaler specifying prescribed minimum quantities will benefit the industry as a whole and will remove from the minds of many manufacturers those ideas of price increases resulting from increased distribution costs.

Putting the finishing touches to the electric thermal-storage heating plant at the new Poplar Town Hall. Above, workmen are seen lagging one of the pipes connected with the storage cylinder, while (right) the final adjustments are being made to the distance temperature recorder on the boiler control panel. *[Elec. Rev. photos.*

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

THERE was a representative gathering at the Criterion Restaurant, Piccadilly Circus, on Wednesday evening (November 2nd) for the annual conversazione and supper-dance of the Transmission Section of the Institution of Electrical Engineers. **Mr. S. R. Siviour,** chairman, and Mrs. Siviour received members with their ladies and guests, numbering 218, who were honoured this year by the presence of Dr. A. P. M. Fleming, the president, and Mr. P. F. Rowell, secretary. Dancing commenced at 8.30 p.m. under the direction of Mr. P. K. Davis, who combined the duties of master of ceremonies with the supervision of the award of a number of handsome prizes, which were duly presented after the supper interval by Mrs. Siviour to Mrs. Masterman, Mr. R. Borlase Matthews, Mrs. Hazelfoot, Mr. F. W. Purse, Miss Todd, Mr. Hazelfoot, Mrs. Markham, Mr. C. E. Stewart, Lady Greer, Mr. H. W. Bibby, Mr. and Mrs. F. C. Orchard, Miss Piggott, and Mr. N. de M. Watsham, while prizes for participants who had travelled the longest distances to attend the function went to Mrs. Siviour (Yorks) and Mr. N. K. Grant (Lancs).

Mr. H. K. Newcombe has been appointed an additional director of Barton & Sons.

Kirkwall Town Council has appointed **Mr. R. F. Walls,** a member of the power station staff, to succeed the late **Mr. H. Ford** as manager of the electricity undertaking. A native of Orkney, Mr. Walls served on " Q " ships during the war and was a sea-going engineer for five years afterwards. He entered the Kirkwall Council's employ when electricity was introduced in the town in 1923.

The Birmingham and District Branch Centre of the Electrical Industries Benevolent Association held its annual dance at the Magnet Club, Witton, on November 4th, and there was a record attendance of 691 members of the Association and

Mrs. F. Forrest presenting the prizes at the E.I.B.A. Birmingham dance. Mr. A. G. Huddleston, hon. secretary of the centre, is on the left

their friends. It is now anticipated that the profits of the dance will exceed £200. There were many side-shows and competitions, and Mrs. F. Forrest, wife of the chief electrical engineer and manager of Birmingham, presented prizes to the winning competitors.

Mr. R. J. Habington, who is retiring after thirty-nine years' service as wiring foreman to the Salisbury Electric Light and Supply Co., Ltd., has been presented with an armchair subscribed for by the members of the staff. The presentation was made by Mr. A. B. Randall, former engineer and manager.

Mr. W. H. Warburton, inspector of mains of the Liverpool Corporation Electricity Department, retired last week after forty-seven years' service and received presentations from the staff.

The first annual dinner and dance of C. Knowles, Ltd., electrical wholesalers, of Nottingham, was held at the Albert Hotel, Nottingham, on November 2nd. The guests included Mr. J. Knowles (T.M.C.), Mr. J. K. Dalby (Revo Electric Co.), Mr. A. R. Miller (Foster Engineering Co.), and Mr. R. H. Honorati (B.T.H. Co.).

Presiding at the annual dinner of the Potteries branch of the E.C.A. and Allied Associations at Stoke-on-Trent on November 3rd **Mr. L. A. Madew** (chairman of the branch) referred to the energy and foresight of the city electrical engineer and the members of the Electricity Committee, and said that the good will and co-operation that existed between the Electricity Department and the E.C.A. could well be followed by other undertakings. The Lord Mayor, who responded, said that the electrical contractors of the city had done their part in helping the city electrical engineer to make the undertaking the success it was. Mr. C. H. Yeaman (city electrical engineer), in proposing the toast of " The Association," said that to maintain progress it was necessary to collaborate with the electrical contractors, and those who were outside the association ought to come into it. The association had disciplinary powers and it was easier to work with an organised body and to let that body deal with difficulties than to correct abuses by individual effort. Mr. W. Riggs (president of the E.C.A.), in reply, spoke of the good feeling between the supply interests and the association. He was dismayed that nothing tangible had resulted from the work of the committee representing the I.M.E.A. and the E.C.A. If they were guided by Mr. Yeaman it would work out in the end to the satisfaction of the two organisations and to the general public. He referred to the great field in North Staffordshire for air-conditioning, and said that it was one of the greatest problems to be tackled, and would be of great assistance to the Association. Mr. L. C. Penwill (director and secretary), who also responded, said that the Committee of Inquiry was definite in its warning regarding the need for a co-operative spirit among those engaged in the industry. He suggested that if the problem were not tackled by the industry it would give rise to a further Government inquiry in the not too distant future.

A re-union dinner of meter engineers formerly at the Ferranti works engaged in and about London will be held at Gatti's Restaurant, Strand, W.C., on November 12th.

There was a large gathering at the annual dinner and presentation of inter-departmental trophies of Callender's Athletic and Social Club, held in the works canteen at Belvedere on October 29th. **Mr. T. O. Callender** presided, supported by Mr. and Mrs. C. Pipkin, Mr. and Mrs. W. G. Hendrey, Mrs. T. O. Callender, Mr. and Mrs. H. Hill, Mr. and Mrs. W. F. Slater, and representatives of Metropolitan Cable Co., Ltd., Anchor Works, London Office, Birmingham, and other branches. Mr. P. V. Hunter was unable to attend owing to indisposition. A message of goodwill was read from Sir Tom Callender, and messages were also exchanged with Dagenham Cables Sports Club, whose annual dinner was held on the same night. After dinner the many trophies were presented to the group winners by the chairman, and this was followed by community singing, brief speeches and a concert.

Sir Harry Brittain is the new president of the Incorporated Sales Managers' Association.

Mr. G. H. Murray has been appointed electrical sales engineer to the E. M. B. Co., Ltd., in the Lancashire and Cheshire areas. Consequent upon this appointment owing to increased business, **Mr. H. E. Bowen** will confine his activities on behalf of the company to the Yorkshire, Derbyshire and Lincolnshire areas. **Mr. C. Cleveley** has been appointed electrical sales engineer to the company in the Midland area. He has been a member of the inside sales staff for nearly twenty years.

Mr. J. Ward, junior mains assistant with the Bingley Urban District Council Electricity Department, has been appointed to a similar position with the Whitehaven Corporation.

The annual dinner of the Liverpool Industrial Section of the Electrical Power Engineers' Association was held on November 5th, **Mr. R. G. Campbell,** chairman, presiding. In proposing the toast of " The Association " Mr. E. L. Morland, chairman of the local centre of the I.E.E., said that the Association was approaching its twenty-fifth year, and it had provided a steady influence in the industry, particularly in the times of trouble and stress through which it had passed. More true than ever was it to-day that education was the means to success. The electrical industry was going to see a greater expansion than ever before, and the younger members would not be able to seize their great opportunities when the time came unless they had thoroughly fitted and educated themselves in the wider sense of the term. Mr. G. Gunn, the Association's vice-president, who responded, described its many-sided work for encouraging technical advancement. The policy had been to try to obtain for the industrial members the same conditions as obtained in the supply section. In industry there was such a variety of jobs that it was very difficult to get a single schedule, but that was a question to which the most strict attention was being paid.

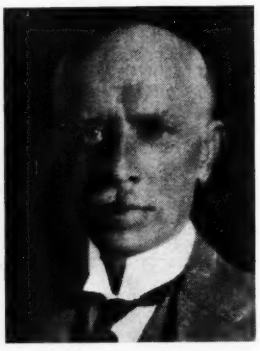
The annual dinner of the Northern Ireland section of the Electrical Power Engineers' Association was held in Belfast on November 4th. **Mr. Reilly,** chairman of the section, presided. Speaking of the factors vital to the campaign which Northern Ireland is conducting for the attraction of new industries, the Rt. Hon. J. Milne Barbour, Minister of Commerce, said that one important factor was the supply of power in sufficient quantities and at cheap rates. In that respect they were particularly fortunate in Northern Ireland. Since the passing of the Electricity (Supply) Act in 1931 the rate of consumption of electricity in Northern Ireland had risen by 151 per cent. as compared with an increase of 62 per cent. in the seven years preceding 1931. Rural electrification was important from the industrial as well as from the agri-

cultural points of view. The Act of 1931 had done much to satisfy the need for rural electrification. In the first year of its operation—1932—only ten towns and villages were being supplied by the Electricity Board and the number of consumers was 3,666. In 1937 the number of towns and villages supplied had risen to 107 and the number of consumers was 35,936. The recent installation of a new 30,000-kW turbo-alternator at the Belfast Harbour power station was a sign of the continued progress of the industry.

Mr. R. P. W. Adeane has been appointed a director of Ransomes and Rapier, Ltd.

Obituary

Mr. John Ferguson, M.Inst.C.E., vice-chairman of British Insulated Cables, Ltd., who died on October 28th last in his seventy-second year, had had a long experience of public works, particularly railway construction. Educated at Stirling High School and the West of Scotland Technical College, Glasgow, he entered the civil engineering profession and was engaged for some years on railway construction in the West of Scotland. In 1901 he became a partner in the firm of Formans & McCall, of Glasgow, and was responsible for the construction of many new railway lines in Scotland and other public works at home and abroad. During the period immediately after the war he acted as Civil Engineer-in-Chief for Railways, under the Ministry of Transport, and when the grouping of the railways was completed he became partner in the firm of Sir Alexander Gibb & Partners. In 1928 he joined the board of British Insulated Cables, Ltd., and in June, 1930, became vice-chairman. Retiring from active professional work as a consulting engineer in 1931 he devoted himself to his many directorships, amongst which were included, in addition to B.I. Cables, the Automatic Telephone & Electric Co., Ltd., the Macintosh Cable Co., Ltd., the St. Helens Cable & Rubber Co., Ltd., and Thos. Bolton & Sons, Ltd.



The late Mr. John Ferguson

Col. J. Clibborn.—The death occurred on October 31st at Lyndhurst, at the age of ninety-one, of Colonel John Clibborn, C.I.E., a well-known Indian engineer. He was at one time engaged by Crompton & Co. to visit India to plan the reorganisation of a branch there and on his return to this country he joined the board as deputy chairman and continued to serve in that capacity until 1926.

Mrs. S. E. Campling.—The death occurred on October 24th at St. Leonards-on-Sea of Mrs. Selina Elsie Campling, wife of Mr. P. G. Campling, M.I.E.E., M.I.Mech.E., who started his duties as electrical engineer for the borough of Bedford on October 25th. Mr. Campling was for some years borough electrical engineer at Great Yarmouth before leaving there to take up a position with the Central Electricity Board in London.

Wills.—Mr. R. E. Lamb, a director of the Northampton Electric Light & Power Co., Ltd., and the Rushden & District Electric Supply Co., Ltd., left £84,537, with net personalty £81,823.

Mr. F. W. Kerr, chairman of Lisbon Electric Tramways, Ltd., and the Public Service Finance Corporation, vice-chairman of the Anglo-Portuguese Telephone Co., Ltd., and a director of other companies, left £32,045, with net personalty £27,998.

Sir Basil Mott, engineer, and senior partner of Mott, Hay & Anderson, left £43,959 (net personalty £36,470).

Mining Electricians' Certificates

AT the November 5th meeting in Cardiff of the South Wales Branch of the Association of Mining Electrical Engineers, instead of the customary paper, a gathering of more than a hundred colliery electrical men were shown numerous types of cable and joints for colliery use. This was followed by a general discussion which it was decided to continue at the next meeting of the branch which is to be held at Cardiff on December 10th.

The meeting was the outcome of a cable-jointing contest at the National Eisteddfod of Wales at Cardiff in August last, when three members of the South Wales Branch (Messrs. E. Ivor David, Vaughan Harries and Idris Jones) adjudicated. Mr. Vaughan Harries paid tribute to the coal-owners of South Wales who had offered prizes for the competition. Mr. Idris Jones gave details of the procedure adopted in adjudicating, and said that not one of the competitors had secured maximum marks, but none of them was a full-time cable jointer. Generally, the standard of work was highly creditable. Major David confirmed the remarks of his co-adjudicators and said there was not one bad joint among any that had been prepared at the Eisteddfod. Mr. H. Bonsall gave a demonstration of vulcanising and Mr. T. R. Thomas described the various samples of cable on view.

Mr. S. B. Haslam, vice-president of the Association, gave an outline of the arrangements made for the holding of an oral examination of members of the Association with a view to the issue of certificates of competency. In outlining the reasons influencing the innovation, he referred to a statement made by Sir Andrew Faulkner, permanent secretary to the Mines Department, at the 1937 convention of the Association that he felt sure that the report of the Committee on Safety in Mines would make certification essential.

The explanatory notes on Rule 131 (a) of the Coal Mines Act, 1911, referred to the First and Second Class Certificates issued after written examination, but it was felt that many good practical colliery electricians were prevented from entering for these examinations by a feeling of inability to express themselves on paper satisfactorily. They now desired to encourage this class of man to obtain possession of a certificate by undergoing an oral examination at which the extent of his technical knowledge could be brought out. The first examination would be held at the South Wales Institute of Engineers, Park Place, Cardiff, on December 10th, 1938, and if sufficient candidates presented themselves a further examination would be held on December 17th.

Decorative Lighting

AT the opening meeting of the decorative light section of the Illuminating Engineering Society in London on October 25th Mr. A. B. Read submitted a commentary on decorative illumination and attempted to assess its desirability. Mr. Read did not define the trend of decorative lighting, as he felt that this was largely speculative, but he was of the opinion that the trend was fundamentally a sane one. He did not suggest that decorative lighting would become more simple, nor would it become more complicated or confused; methods by which light had been produced had remained constant enough to allow of extraordinary variety. Mr. Read concluded by stressing the difficulty of expressing himself clearly on a subject which, he said, was really a matter of feeling rather than words.

Following the paper a series of lantern slides illustrated comparisons of what was considered good and bad in lighting fittings design. An interesting discussion followed the speaker's discourse.

In the Courts

Radio Patent Action

THE House of Lords on November 3rd delivered judgment in the action brought by Electric & Musical Industries, Ltd., and the Boonton Research Corporation against Lissen, Ltd., and G. Kalis, on plaintiffs' appeal from the judgment of the Court of Appeal, reversing the judgment of Mr. Justice Luxmoore in the Chancery Division.

The plaintiffs brought the action for an injunction (and the usual ancillary relief in a patent action) to restrain the defendants from infringing the plaintiffs' letters patent for "Improvements in Electric Wave Amplifying Apparatus" for use in wireless receiving sets. Mr. Justice Luxmoore held that the defendants had infringed claims 1 and 2 of the plaintiffs' specification and granted injunctions against both of the defendants and enquired as to damages. He also dismissed the defendants' counter claim for revocation of the plaintiffs' letters patent.

The Court of Appeal, on the appeal of the defendants, held that on the proper construction of the plaintiffs' specification claims 1 and 2 were invalid by reason of anticipation and claims 3 and 4 by reason of insufficiency and ordered the patent to be revoked but directed that the order for revocation should lie in the office for a period pending an appeal to the House of Lords.

The House of Lords, after hearing arguments lasting twenty days, by a majority of one affirmed the judgment of the Court of Appeal. Lords Russell of Killowen, Macmillan and Wright forming the majority and Lords Atkin and Porter the minority. The appeal of the plaintiff companies was accordingly dismissed with costs.

Hailé Selassie's Claim

The Court of Appeal on November 3rd adjourned the hearing until December 1st of the appeal by Cable and Wireless, Ltd., from the judgment of Mr. Justice Bennett in the Chancery Division awarding to Hailé Selassie £10,613 under an agreement to establish a radio-telegraph service between Addis Ababa and Great Britain.

Mr. Wynn Parry, K.C., for the company, submitted that the money had passed by way of succession to the King of Italy and said that the company was ready to pay it to any person entitled to it. Having regard to the Prime Minister's statement that Britain intended to recognise Italian sovereignty in Ethiopia, he suggested that the appeal should stand adjourned until that event took place.

Commercial and Industrial News

Lighting Fittings Showrooms. New Manchester Cinema. Eastbourne Agreement. Kitchen Planning. E.D.A. Calendar. Demonstrations in Schools.

New London Showrooms

TO provide additional facilities for their customers in the South, T. B. Morley & Co., Ltd., of Hull, the manufacturers of "Morco" lighting fittings and wholesalers of domestic electrical appliances, have just opened extensive new showrooms at Maidstone House, 25-27, Berners Street, London, W.1, under the managership of Mr. L. J. Fletcher. The planning of the premises has been carried out on the most up-to-date lines and the restriction of articles on view to the minimum, compatible with being representative, greatly enhances their display value. Doubtless many will remember the showrooms when, until a few months ago, they were occupied by Elexcel, Ltd. Much the same general arrangement has been retained, though additional facilities have been provided for the showing of lighting fittings. Although tastefully dressed, the windows have been left so as to permit a clear view of the interior, where small graceful partitions of

The new showrooms of T. B. Morley and Co., Ltd., in Berners Street, W.1

limed oak divide the showrooms into sections devoted to various domestic appliances such as imitation coal fires, washing machines, water heaters and vacuum cleaners. An attractive centrepiece is furnished by a tall octagonal column emitting concealed lighting from the top. By means of swivel devices, two inset fires can be shown on each of the sides of this column, and on an illuminated counter above is an attractive selection of bronze figures, table lamps, kettles, &c. The lighting fittings shown are almost all of "Morco" manufacture and Mr. A. Dawson, the London manager, states that the company is now in a position to produce every type of unit. Its range of fittings has, in fact, been considerably extended recently, and new additions include period, wood and wrought iron units. In addition to the higher class fittings displayed in the main showrooms, a very wide selection of the "popular," medium and lower-priced range can be inspected in another section of the showroom, where all fittings on view are of the company's own manufacture exclusively. In a further section set aside for industrial and commercial fittings there is a very wide range of enclosed units, &c., and facilities are provided for comparing and testing the efficiencies of different types and makes of equipment.

The Apollo Cinema, Manchester

The new Apollo Cinema, Manchester, is of unusual design. It has been built around another cinema, and is "L" shaped in plan. In the auditorium the colour scheme is a large area of Holophane moulded contour designed by Mollo & Egan, Ltd., in which the colour-lighting is continually and imperceptibly changing. The moulded contour scheme embraces a special stage design which is patented by Holophane, Ltd., and this is incorporated as part of the area of decorative plaster work. Behind the sloping walls the switchboard and equipment is installed. The decorative lighting of the large area of moulded contour which covers the front of the house is accomplished by troughing arranged along the sides of the walls and across the ceiling. The sections of the troughing were adjusted to cover different areas of the moulded contour, to give a uniform lighting effect. Along the front of the balcony there is an additional line of "throw" troughing focused on the central portion of the ceiling. For the front area over the stage a special concentrated type of footlight with a long throw has been designed, and this projects on to the front section, thus completing the enfilading of the decorative plaster work with lighting equipment. The stage lighting consists of a footlight and three battens in four-colour circuits with two nine-unit wing flood trolley units for side lighting. Spot arcs are fitted on a porch level with the ceiling at each side, two spots are arranged at floor level and two are in the ceiling void. The selector control switchboard is built at the back of the dividing wall. The stage board is a four-panel control connected by a change-over switch and telephone cables with the operating box, in which there is a three-panel board, so that the lighting can be operated from the box or the stage. The auditorium lighting over the balcony is by means of three transverse cones in which are concealed Holophane colour lighting equipment. At the rear of the balcony there is a cornice lighting trough on the back wall. The vestibule and entrance hall is lighted by units of the Holophane built-in type, with several special designs in corridors and on the stairs. The exterior canopies are lighted by Holophane recessed dome units built into the canopy. The architects for the building were Messrs. P. Cummings and A. M. Irvine, and the electrical contractors were W. J. Furse & Co.

The new Apollo Cinema, Manchester, showing (left) the exterior and (right) the auditorium

Eastbourne and Electrical Contractors

At a recent meeting of the Eastbourne Town Council a letter was read from the local branch of the E.C.A. opposing recommendations of the Electricity Committee and proposing that (1) when a contractor introduces a customer to the Corporation showroom and a sale results he shall receive the full trade discount; (2) when a contractor introduces a customer and a hire-purchase sale results, he shall receive 15 per cent.; (3)

when no introduction is made by the contractor he shall receive 10 per cent. Councillor Skinner stated that the Committee had accepted clauses (1) and (3), and had adjourned the question of (2) and proposed to come to an amicable arrangement between the Association and Committee. An amendment was carried that the Association's proposals should be accepted. Councillor Rush said that he was only too anxious that the Electricity Department should recognise the contractors as their friends. They wanted to work together and to have no antagonism.

A Window Display Competition

Moffatts, Ltd., have announced the results of a window display competition which they promoted for increasing the sales of their electric cookers. The contest was divided into two classes: class "A" for cities with a population above 100,000, and class "B" for towns and cities with a population below 100,000. The prize winners in class "A" were: — First: Electricity House, Ltd., Leeds. Second: Willesden Corporation Electricity Department. Third: Electricity House, Ltd., Bradford. In class "B" the prizes were as follows:—First: Northampton Electric Light & Power Co., Ltd. Second: Wallasey Corporation Electricity Department. Third: Whitstable Electricity Co. In addition to winning the first prize in class "A," Electricity House, Ltd., Leeds, won the grand challenge cup for the window obtaining the highest number of points in either class. In the accompanying illustration we show the winning class "A" window display.

Two window displays showing (top) a prize-winning effort by Electricity House, Ltd., Leeds; (centre) a Berry fire display at the "Northmet" Wembley showrooms. Below is seen the exterior of the new Birmingham premises of the E.G.S. Co., Ltd.

Fluorescent Lighting

How invisible radiations in the ultra-violet region of the spectrum can be made to excite certain chemicals causing them to fluoresce and so to provide luminous decorative and trick effects, is explained in a 16-page booklet issued by the Strand Electric & Engineering Co., Ltd., under the title of "Black Light." This shows how the introduction of the 125-W mercury discharge lamp with a black-glass bulb has made possible results that previously could be obtained economically (though cumbrously) only by means of an arc lamp with a black glass filter.

Electrical Plant for Ships

Laurence, Scott & Electromotors have supplied twenty winches of the "Scott" electric type 5-ton for the Shaw Savill motor ship *Waimarama*. These winches are fitted with the company's "creeping control" system. The company has also supplied a number of electric cargo winches, motors and motor generator sets for the Union Castle motor ship *Pretoria Castle*.

A New Lamp Cut-out

We have received from the Insular Electric Lamp Works, Ltd., a specimen of new cut-out for its "Supalite" lamps which it is distributing to its customers. This has an effective colour scheme of pale blue, yellow and brown, and has a slotted stand for the insertion of five lamps ranging from 15 to 100 W. Special attention is drawn to the company's 1s. lamp.

Kitchen Planning

Although the housewife has little say in the matter the planning of the kitchen makes all the difference to her interest in kitchen work. A well-planned kitchen leads to efficiency and thus there is more likely to be a demand for an electric cooker and other electrical appliances than there is in an indifferently planned one. The Kitchen Planning Centre, 2/5, Old Bond Street, London, W.1, offers free information and a well-produced brochure, containing illustrations and layouts, on kitchen planning, and we understand from Mr. B. D. Copland that these are available not only to supply engineers, builders and architects, but also to private individuals who wish to carry out their own planning. In the suggested layouts special attention is given to grouping so that there is a minimum of walking to and fro—for instance, the sink, washer under draining board, and ironing table are all closely associated. The Centre is issuing a seal for approved appliances.

High-frequency Apparatus Developments

The United Insulator Co., Ltd., the sole representation in the country of the Hescho Co., of Hermsdorf, manufacturers of high-frequency apparatus for radio, television, telephony, measuring and indicating purposes, &c., is holding the second of what are, we understand, to be annual exhibitions, at the Hotel Great Central, Marylebone, from November 14th to 18th.

Water Heating

Technical matters have now been introduced into the water-heating catalogue of Ferranti, Ltd., so that included in the 36-page booklet are short articles dealing with the choice and installation of heaters. Full specifications of individual models are given, and there are graphs for calculating the heating-up period and average hot-water supply per hour.

The Southport Showrooms

Southport Corporation Electricity Committee last week re-opened the municipal showrooms, Lord Street, where extensive alterations have been carried out. The main improvements embrace new and enlarged office accommodation, and a new demonstration room. Originally there were two shops divided by two walls, which rendered supervision difficult. At the opening ceremony, Councillor Chorlton said that the Committee had endeavoured to take a long view, and to anticipate the further growth of the undertaking. They also had borne in mind the possibility of the Corporation's taking over the Birkdale and District Electric Supply Co. at no distant date. The acquisition of that undertaking might at once increase the showroom staff and the demand on their showroom space, and the alterations they had made, and hoped to make, would allow for this expansion.

London Engineering Works Extension

For the fourth time during the last ten years G. A. Harvey & Co. (London), Ltd., have found it necessary to make a considerable addition to their works at Woolwich Road, Charlton,

S.E.7, and with the latest extension the total area covered by the works is 25 acres. The new building, which is nearing completion, was designed by Mr. K. M. Roberts, M.Inst.R.A., and is a reinforced concrete structure of five storeys, 152 ft. long, 92 ft. wide, and 72 ft. 9 in. in height to the top of the parapet, with a total floor area of about 70,000 sq. ft.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that the cost-of-living figure on October 1st (55 per cent. above the 1914 level) will not involve any alteration in wages on the third pay-day in November.

The Batti-Wallahs

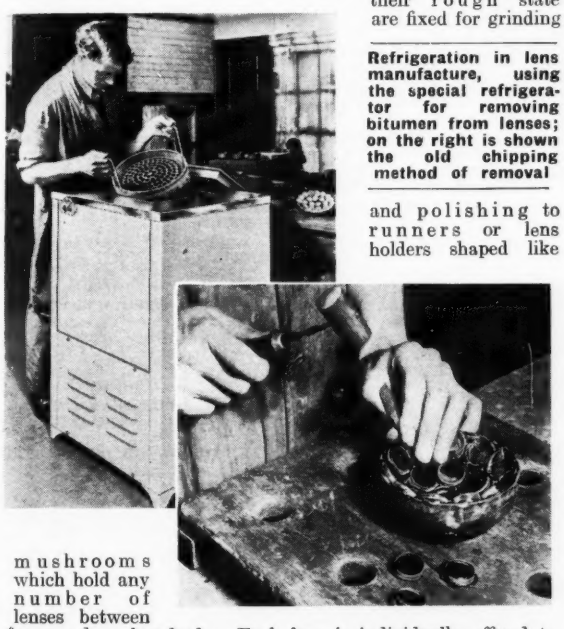
Vice-Admiral Gordon Campbell, V.C., D.S.O., was the principal guest at a luncheon of the Batti-Wallahs' Society on Tuesday last. There was a good gathering which thoroughly enjoyed the Admiral's sea stories and was impressed by his strong views on the importance of the Navy to the individual citizen. He emphasised how dependent the modern Navy was upon the engineer and thought that the engineer was inadequately represented at the top. Mr. R. H. Gummer (president) was in the chair, and Mr. F. Pooley (past-president) proposed a vote of thanks to Admiral Campbell. The next luncheon takes place on December 14th.

A Radio Valve Guide

The radio valve has become a most intricate piece of apparatus and engineers in other branches of electrical work have found it difficult to keep up with its development. They will, therefore, be glad to have the guidance given in the valve data supplement included in this week's *Wireless World*. Over a thousand valves are listed, the principal characteristics, type of base and price being given in each case.

Refrigeration in Lens Manufacture

An interesting recent application of refrigeration is in connection with the manufacture of camera lenses at the Kodak factory at Wealdstone, Middlesex. The lenses in their rough state are fixed for grinding and polishing to runners or lens holders shaped like mushrooms which hold any number of lenses between four and a hundred. Each lens is individually affixed to the runner by warm pitch which, of course, sets hard and holds it firmly in position for grinding and polishing. After these processes were completed the task of removing the lenses from the holder used to be done by hand with a small mallet and knife. A fair amount of pitch still adhered to the lenses after their removal. This had to be cleaned off before anything further could be done, and a considerable number of breakages was unavoidable. The General Electric Co., Ltd., recently supplied a special "Coldair" refrigerator unit which enables the job of removing and cleaning the lenses to be accomplished faultlessly and in a fraction of the time previously required. The apparatus installed is about as large as a medium sized ice-cream unit. Into this is poured a solution of two parts of methylated spirit and one part of water (this ratio may be varied slightly either way). The temperature of the mixture is then reduced to about 5 deg. F. and the unit is ready for working. The lens holders or runners are placed in a wire basket and immersed in the liquid for one or two minutes, and when removed the lenses need just a touch of the fingers to slide off practically free from pitch. The principle is that of difference in coefficients of contraction, the glass contracting more readily than the pitch at low temperature.



Refrigeration in lens manufacture, using the special refrigerator for removing bitumen from lenses; on the right is shown the old chipping method of removal

The "Henley Telegraph"

The autumn issue of the *Henley Telegraph* contains, in addition to reports on the social and sports activities of the company, an interesting article by Mr. W. F. Bishop, director and general manager, in which he gives some of his impressions of South Africa gained during his visit to the Union earlier in the year.

E.D.A. Activities

Specimen copies are now available of the E.D.A. calendar for 1939, "Power through the Ages." Each of the monthly sheets bears a picture attractively produced in full colour under which is an appropriate inscription. The November sales and publicity programme of the Association gives a price-list for various quantities. Two designs of book matches are also available, each produced in colour and bearing a suitable electrical slogan. Individual overprinting can also be arranged on the inside of the books if desired. The Association is issuing a new double-crown poster in bright colours which has been designed to draw attention to the "over the sink" water heater, and the programme contains particulars and prices of stereos for local advertisements to link up with the national lighting campaign.

The new E.D.A. calendar

A guide to correct lighting has been circularised to 100,000 factories and workshops throughout the country by the Association in connection with its campaign for providing free assistance to factory owners in the matter of lighting to comply with the requirements of the new Factories Act. The guide indicates the broad principles of good factory lighting with recommended illumination values for individual trades and is intended as a reference book for all those concerned with the illumination of industrial premises.

"Punch" Almanack

The *Punch* almanack is once again an early reminder of the approaching festive season. In drawing and in story Mr. Punch provides a shillingsworth of excellent entertainment.

Illumination Design Course

On Friday last an illumination design course, organised by the E.L.M.A. Lighting Service Bureau, was concluded at Victoria Hall, Sheffield, when Mr. J. W. Howell, district engineer of the Bureau, gave a lecture on "Up-to-date Factory Lighting," in which he explained the influence of good lighting on works efficiency, characteristics and applications of various types of industrial fittings, the application of electric discharge lamps and methods of solving special lighting problems. The lecture was followed by a discussion opened by Mr. H. A. Wainwright. Lectures previously given were "The Partnership of Light and Vision," by Mr. W. J. Jones (October 14th); "A Review of Modern Lighting Practice," by Mr. H. Lingard (October 21st); and "Modern Electric Lamps and Their Characteristics," by Mr. L. E. Buckell (October 28th).

Demonstrations in Schools

During the recent Health and Safety Week in Erith the local Electricity Department took the opportunity of educating the rising generation in the domestic uses of electricity by placing electrical exhibits in Erith schools. Talks were given to the children on matters regarding their health and safety, in the course of which the value of electricity in promoting health and safety in the home was emphasised. The accompanying illustration shows Miss V. Starkey, head demon-

Teaching the young idea at Erith

strator of the Erith Electricity Department, surrounded by a group of interested school children. These housewives of to-morrow thus received lessons at an early age in electrical housekeeping.

Air Raid Precautions

Some engineering aspects of air raid precautionary measures in power stations were dealt with in a short paper by Dr. H. Chatley and Mr. Hal Gutteridge which was read before the Society of Engineers in London on November 7th.

The discussion of bomb effects and structural matters preceded reference to the fact that machines were principally liable to be damaged by structural collapses and disturbance of services rather than by direct injury. It was suggested that the inflammable contents of buildings must be reduced. The avoidance of short circuits by the provision of proper conduits, reactors to deal with surge and fuses was emphasised. Stress was laid upon the need for main switches to be noticeable, accessible and easily controllable.

The value of small independent lighting sets for emergency use was remarked on. If such sets were oil driven, special regard must be had to possible fire and leakage hazards. Skeleton staffs and services for essential maintenance operations during air raids were of importance. Repairs after damage called for skilled labour rather than amateur volunteers, however willing. The economics of A.R.P. were considered, attention being drawn to the differential results which, during peace, favoured the parties who neglected precautions.

A Large Fan Installation

In a new building at the Elizabeth Garrett Anderson Hospital, Euston Road, twenty Vent-Axia "Silent Six" stale-air extractors have been installed, as specified by Stanley Hall, Easton & Robertson, the architects. The illustration in the next column of the exterior of the new building shows the extractors installed in the corners of the windows.

Prices of Materials

Henry Gardner & Co., Ltd., report, November 9th: Copper bars (best selected), sheet and rod, no change. English pig lead, no change. Spelter, £14 11s. 3d., 5s. decrease. English block tin, £212 5s., 5s. decrease. Mercury, £14 5s., 5s. increase.

Frederick Smith & Co., report, November 9th: Electrolytic copper bars, £52 10s., £1 decrease. Ditto, ditto, wire rods, £57 5s., £1 increase. Ditto, ditto, h.c. wire, 8 7/8d., 1/4d. decrease. Silicium bronze wire, no change.

Edward Till & Co., report, November 9th: India-rubber, Para fine, no change.

Tar Mixing and Dust Extraction

Additional plant recently supplied to Maxwell's Quarry, Coleraine, Londonderry, includes an electric tar boiler and a tarmac mixing machine, which is believed to be the first of its kind to be installed in Northern Ireland. A Crompton Parkinson 45-h.p. "Klosd" squirrel-cage motor operates the Pegson tarmac plant, which has a capacity of 20 to 25 tons per hour. The Clarmac tar boiler has a capacity of 1,500 gal., and the loading is 36 kW. Power for the boiler is provided at a low rate during the night by the Antrim Electricity Distribution Co. The plant functions during the day without reheating, except occasionally during the lunch hour when the rest of the works is shut down. The Standard & Pochin

A 10-HP Crompton "Klosd" motor operating dust extractor at Maxwell's Quarry, Coleraine

dust extractor is fan-operated by a 10-HP "Klosd" squirrel-cage motor, and is capable of extracting 3 tons of dust a day, which is either made into blocks or marketed as dust, for which there is a demand in England. The extraction plant was installed primarily to ensure the cleanliness of the crushed stone but as the intake ducts are fitted close to the outlets from the crushers and cones the extractor considerably minimises the dust nuisance for the quarry plant as a whole. A separate extraction plant is also run in conjunction with the tarmac mixer.

How to Get to Prescot

British Insulated Cables, Ltd., has produced a useful one-inch scale map designed for the convenience of visitors to their Prescot works. Prescot is shown as the centre of a circle of about ten miles radius. All the first-class and secondary roads in this area leading to the works, as well as railways, are plainly drawn and distinctively coloured. The cover bears an aerial view of the works.

New Catalogues and Lists

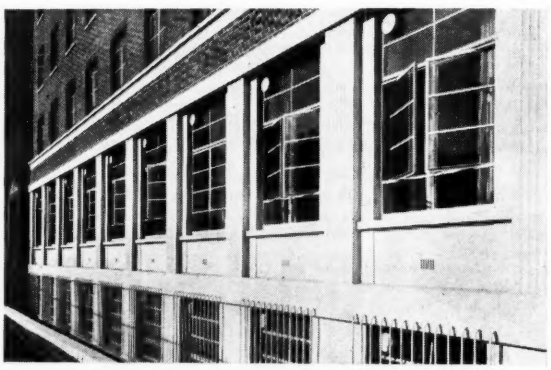
The Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2, has produced a new 70-page fully illustrated electric heating catalogue dealing with reflector, radiant and coal fires, industrial heaters and thermostats.

Midland Electric Manufacturing Co., Ltd., Tyseley, Birmingham, 11.—A booklet dealing with redesigned motor control gear, including a new isolator and including full technical details.

Time Switches & Instruments, Ltd., 120, Victoria Street, London, S.W.1.—An abridged catalogue of time switches.

Orel-Micro Electric, Ltd., 39, Berners Street, London.—Leaflets dealing with the "Hanley" and "Clipshave" British-made dry shavers.

Euston Manufacturing Co., Ltd., 56-60, Grove Road, Walthamstow, London, E.17.—A price list of "mirrored-design" decorated electric light fittings.



A new building of the Elizabeth Garrett Anderson Hospital in which Vent-Axia extractors have been installed

W. Edwards & Co., Allendale Works, Vaughan Road, Loughborough Junction, London, S.E.5.—A technical catalogue of a new range of mercury diffusion pumps.

R. A. Lister & Co., Ltd., Dursley.—A leaflet relating to a pressure-controlled domestic pump set.

British Insulated Cables, Ltd., Prescot, Lancs.—A list of spare parts for B.I. meters, and particulars of disconnecting network boxes, an earthing rod, and rubber cables and wires.

Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester, 6.—A 48-page illustrated catalogue of radio and electrical accessories.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Booklets relating to electrical control of machine tools, oil-pump metal-clad circuit-breakers, and iron-clad switches, fuses, and contactors. Also a booklet giving draft specification of motor control gear for boiler-house auxiliaries.

John Dugdill & Co., Ltd., Hazel Grove, Stockport.—Details of movable, focusing, self-sustaining bracket lighting fittings.

Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Details of "Chloride" emergency lighting.

Private Arrangement

F. W. Belschner, trading as Imp Radio Company, 202, Earls hall Road, Eltham, London, S.E.9.—A meeting of the creditors was held recently at the offices of C. Latham & Co., 185/8, High Holborn, London, W.C. The statement of affairs showed ranking liabilities of £1,696. The net assets were £496, leaving a deficiency of £1,200. It was stated that debtor had been negotiating with friends as a result of which he hoped to be able to submit an offer for acquisition of the assets for the sum of £400. It was decided that the matter should be dealt with under a deed of assignment with Mr. C. Latham and Mr. C. E. M. Emmerson of Josolyne, Miles, Page & Co., King Street, Cheapside, London, E.C., as joint trustees, with a committee. It was stated that any offer which was received for the assets would be considered by the trustees and the committee.

Bankruptcy Proceedings

J. J. Eastick & Sons (a firm), wireless factors, 118, Bunhill Row, London, E.C.—At the London Bankruptcy Court on November 2nd before Mr. Deputy Registrar Mellor, an application was made for the Court to approve a scheme of a composition to the creditors of 5s. in the £ to be paid immediately after the approval of the scheme and 6d. in the £ to be paid within six months. The liabilities expected to rank for dividend amounted to £62,526, while the assets, after allowing for preferential claims, were estimated to produce £18,644. The Official Receiver estimated that a sum of £22,612 would be required to pay the Court fees, composition and expenses. He added that he was of the opinion that the composition, with its immediate provision of 5s. in the £, offered an advantage to the joint creditors. It was also clearly an advantage to the creditors in the separate estates of the partners. The composition was approved.

F. W. T. Layton and **R. E. Mills,** trading in partnership as East Anglian Wireless Co., Hamilton Road, Felixstowe, radio engineers. (Separate application of F. W. T. Layton.)—At the Shire Hall, St. Helens Street, Ipswich, on November 2nd

F. W. T. Layton applied for his discharge, which was granted, subject to a suspension of nine months. The Official Receiver stated that Layton had traded in partnership with another and the receiving order was made in 1932.

A. G. Field, 27, Station Road, Chadwell Heath, and 22, Rowallan Parade, Dagenham, radio dealer.—The public examination took place at the Shire Hall, Chelmsford, recently. The statement of affairs returned disclosed liabilities of £1,394 and assets of £719, leaving a deficiency of £675. Debtor attributed his failure mainly to losses on gambling in stocks and shares. The examination was adjourned.

L. F. Milnes, radio and electrical appliance dealer, residing in lodgings at Park View, Barkisland, near Halifax, and formerly carrying on business at 66, Gibbet Street, Halifax.—First meeting November 11th at 71, Manningham Lane, Bradford. Public examination December 9th at the County Court, Prescott Street, Halifax.

A. L. Drake, electrical contractor, 185, Morley Street, Bradford.—Last day for receiving proofs for dividend November 16th. Trustee, Mr. W. F. Cresswell, 71, Manningham Lane, Bradford, Official Receiver.

Company Liquidations

Century Refrigeration Co., Ltd., Princes Street, Hanover Square, London, W.—At a meeting of the creditors the statement of affairs showed ranking liabilities of £16,152. The net assets were £2,314, leaving a deficiency, as regarded the creditors, of £13,838. The issued capital was £10,000, and so far as the shareholders were concerned there was a deficiency of £23,838. The company was registered in August, 1936, taking over assets valued at £13,000, and commenced trading in September, 1936. The nominal capital of £10,000 was allotted for cash and the company had been concerned with the production of commercial and domestic refrigerators and ice-cream vending machines. A substantial amount had been expended on experimental work. During the present year the turnover had been £11,437, but after allowing for all the expenses, &c., there was a net loss incurred of approximately £11,000. It was further stated that the usual resolution for voluntary liquidation had been passed by the shareholders and that Mr. Sydenham, of 1/2, Trump Street, E.C., had been appointed liquidator.

Crabtree's Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. R. Russam, 38, Piccadilly, Bradford.

Brentwood District Electric Installations, Ltd.—Winding-up voluntarily. Liquidator, Mr. J. N. Campbell, Palace Chambers, Bridge Street, Westminster, S.W.1.

Elmore Electric Clocks, Ltd.—Winding up voluntarily. Liquidator, Mr. T. G. Piper, Bush Lane House, Cannon Street, London, E.C.4.

South West Electricity, Ltd.—Particulars of claims by November 18th to the liquidator, Mr. B. R. Dunning, High Street, Honiton, Devon.

Radio Rentals, Ltd.—Meeting December 7th at Ibex House, Minories, London, E.C.3, to receive an account of the winding-up by the liquidator, Mr. A. W. Bentley.

Bonner's Radio, Ltd.—Meetings December 9th at 47, Mosley Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. A. T. Eaves.

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 2nd :—

Ace (lettering and design). No. 587011. Class 6 (III). Electric washing machines.—J. M. Beaumont and K. W. Smith, trading as the Ace Electric Co., 35, Queen Street, Huddersfield.

Design only. No. 582832. Class 8 (III). Microphones, loudspeakers, radio and audio-frequency electro-magnetic amplifiers, electric resistances, transformers (not being machines), static convertors, rectifiers, &c.—Eugen Bauer Ges., Stuttgart, Germany (British representatives, W. P. Thompson & Co., 12, Church Street, Liverpool.

Sterilamp. No. 586697. Class 8 (III). Lamps for producing ultra-violet rays, not for surgical or curative purposes.—Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. (British representatives, G. Raymond Shepherd, 2, Norfolk Street, Strand, W.C.2).

Lumora. No. 601029. Class 9 (IV). Luminous discharge tubes.—Electrolumination, Ltd., 9, Barnsbury Park, N.1.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

GUILDA hair dryer.

New Melbourne Showrooms

IMPOSING new electrical showrooms have been opened by the British General Electric Co., Pty., Ltd., at Melbourne, Australia, in furtherance of the progressive policy of the parent company, the General Electric Co., Ltd., of England, in its desire to develop overseas markets with British resources.

The new Melbourne showrooms have been modelled on similar lines to the head office showrooms in London. The accommodation now consists of six spacious rooms to demonstrate the various applications of electric lighting and electrical household appliances, and the display is methodically arranged being arranged with the definite intention of selling ideas in addition to the sale of actual fittings.

The remodelling and alterations were carried out by A. & K. Henderson & Partners, architects, the builder was Mr. G. Reid, the electrical contractors J. P. Aarons & Co., and the ventilating engineers Gardner & Naylor Pty, Ltd.

The showrooms were officially opened by the Hon. F. E. Old, Minister in Charge of Electrical Undertakings in Victoria. Mr. Old was introduced by Mr. W. Caithness, of Sydney, director of the B.G.E., in the absence of Mr. E. Hirst,

The new Melbourne showrooms of the British General Electric Co. showing (left) one of the new lighting fittings rooms and (right) a display of cookers and refrigerators

so that all items are shown in surroundings similar to those in which they will be subsequently installed. Modern, period and crystal lighting fittings are displayed in the right atmosphere to set off their own individuality. Household electrical appliances such as refrigerators, cookers, fires and vacuum cleaners are also attractively displayed in their proper setting. Special demands in the lighting field (for unusual fittings or methods to harmonise with any particular architectural scheme) will be met by the company's expert illuminating engineers and designers. Even in these cases, however, the showroom plays its part, its artistic layout and equipment

managing director of the company, who is on a visit to England. Mr. Old remarked that the up-to-date display of lighting fittings and other electrical apparatus was a tribute to the progressive methods of the company and a striking example of the remarkable extent to which electricity was now used. Nearly £20,000,000 of public money was invested in the State electricity undertaking, and a Bill had been introduced into the State Parliament for an extension of its major activities because of the ever-increasing demand for electrical services. A hydro-electric scheme was to be established on the Bogong High Plains with four power stations.

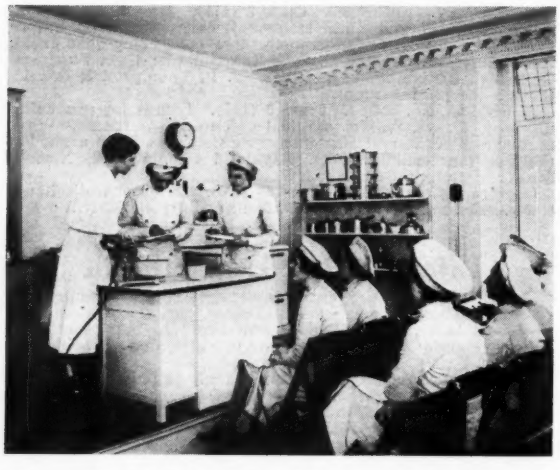
Electricity Supply

Lighting, Domestic, Power

Barnard Castle.—RURAL SUPPLIES.—The Rural District Council has approved plans by the North-Eastern Electric Supply Co., Ltd., for supplying electricity to Winston and Park House Gainford. It has decided to urge the company to supply electricity to Lynssack, Softley, Bowes Close, Ramshaw, Lands, Hamsterley, and Woodland.

Barrow-in-Furness.—EXTENSION.—The Electricity Committee is to provide additional extra-high-voltage feeders and switchgear at a cost of £11,474, extend a distributor to North Scale (£1,634), and lay mains to Vickerstown (£826), Askam (£500), and Blawith (£198).

BULK SUPPLY.—At a cost of £6,527 the Electricity Committee is to provide a bulk supply to the Millom R.D.C.



The new demonstration room which forms part of the extensions of the London School of Electrical Domestic Science

Berwick.—WASHBOILERS FOR COUNCIL HOUSES.—Electric washboilers are to be installed by the Town Council in houses on the Billendean estate.

Birkenhead.—SWITCHGEAR IMPROVEMENTS.—The electrical engineer has submitted to the Electricity Committee details of a scheme for modifying the main 6,600-V switchgear at the Craven Street works, as a part of the air raid precautions scheme and in compliance with the Electricity Commissioners' memorandum on fire risks at generating stations. The cost will be £5,823, and a provisional order is to be placed with the Metropolitan-Vickers Electrical Co., Ltd., the suppliers of the existing switchgear.

Brighton—BOOSTER PUMPS.—The Water Committee is to install two electrically driven booster pumps at the waterworks at a cost of £956.

Cheltenham.—STREET LIGHTING.—The borough electrical engineer has prepared a scheme for improving the lighting in High Street between Hale's Road and Gloucester Road, and experiments are to be carried out with horizontal colour-corrected mercury electric-discharge lamps.

Clacton.—BETTER LIGHTING.—The Urban District Council has recently decided to improve the lighting of a section of Old Road between Pier Avenue and West Avenue. Steel posts with extension arms will be erected, the 300-W lamps being suspended centrally over the roadway.

Douglas (I.O.M.).—ENGINEER'S REPORT.—Including 3.5 million kWh supplied in bulk to the I.O.M. Electricity Board the Electricity Department sold 9.4 million kWh in the past year, an expansion of 16 per cent. There was an increase in the number of consumers from 5,359 to 5,814 and the sales per consumer (excluding bulk supply and public lighting) rose from 880 to 938 kWh, with an improvement from 189 to 218 kWh per head of the population. The number of public lamps connected increased from 694 to 744 and domestic appliances on hire (cookers, kettles and water heaters) from 1,964 to 2,452. That the domestic development of the undertaking compares favourably with the position in Britain generally is shown by figures which Mr. B. Kelly, the borough electrical engineer and manager, gives in his report. One in five of the Department's consumers uses an electric cooker compared with one in eight generally, and one in fourteen uses an electric water heater (against one in twenty-four). Illustrating the effect of weather on electricity sales, Mr. Kelly states that in the ten months to the end of January the output expanded by nearly 17 per cent., while in February and March, when the weather was unusually mild, the growth was only 8 per cent.

Great Britain.—IMPROVED OUTPUT.—Returns rendered to the Electricity Commissioners show that 2,195 million kWh was generated by authorised undertakings in October, an increase of 8.2 per cent. over the corresponding month of last year. The expansion since the beginning of the year is equivalent to 6.8 per cent.

Harrogate.—OVERHEAD LINES.—The Corporation is to erect overhead lines for providing a supply of electricity to houses at Lofthouse.

London.—SCHOOL INSTALLATION.—The L.C.C. is to renew the electrical installation at the Hutton residential school, Essex, at a cost of £5,600.

BETHNAL GREEN.—In October, 1936, the Council assumed complete management of the undertaking, and the 1937-38 report of the borough electrical engineer and manager (Mr. E. E. Jolly) is therefore the first based on a complete year's working under the Council. In the period sales increased by 11 per cent. to 18.1 million kWh, of which 9.9 million kWh was supplied for private lighting and domestic uses (29 per cent. increase). The installation department had a busy year, providing 1,322 rental wiring systems and installing 1,009 cookers, 536 water heaters, 144 wash boilers and 1,668 other domestic electrical appliances. Mains were also laid in nine housing estates. There was a surplus of £21,381 on the year's working, which, with £9,419 brought forward, gave a balance of £30,800. Of this £19,470 was allocated to capital expenditure met out of revenue and there was a contribution of £3,750 to the rates.

Macclesfield.—ACQUISITION OF UNDERTAKING.—The Corporation is likely to promote a Bill in the present Parliamentary Session for the purpose, *inter alia*, of acquiring part of the electricity undertaking of Electricity Company of Macclesfield, Ltd.

Malvern.—MAINS.—The recommendation of the Gas & Electricity Committee to ask for sanction to an additional loan of £2,000 for mains and services has been approved.

Mid-Sussex.—STREET LIGHTING.—A system of street lighting covering the villages of Handcross, Slaugham and Warninglid has been inaugurated by Central Sussex Electricity, Ltd.

Mountain Ash.—ANNUAL REPORT.—According to the 1937-38 report of Mr. E. W. Jones, the general manager of the Electricity Department, the number of consumers increased by 80 to a total of 8,280, which is not far short of the number of premises in the area. The undertaking is notable for its low lighting flat rate, which during the past year stood at 2d. per kWh, with a reduction for one quarter to 1d. To a certain extent these low charges have encouraged the use of small domestic electrical appliances off the lighting circuit, but the conditions in this coal mining area are not conducive to domestic electrification. The average sales per consumer were 76 kWh (against 64 kWh in the previous year), and the total sales were 2,589,000 kWh, an improvement of 10 per cent. There was a gross profit of £1,039, the undertaking being free of debt.

Norwich.—HERRING COOKERY DEMONSTRATIONS.—In conjunction with the Electricity Department the Herring Board arranged demonstrations of herring cookery at the Stuart Hall during the Norwich Civic Week.

Oxford.—TARIFF REDUCTIONS.—The following reduced charges have been adopted by the City Council: Business two-part tariff, standing charge reduced from £12 to £10 per kWh per annum; ordinary power, present charge reduced by ½d. on the first 250 kWh per winter quarter, making a flat rate of 1¼d. per kWh all the year.

Plymouth.—AIR RAID PRECAUTIONS.—A scheme of air raid precautions, costing £38,798, is to be carried out by the Electricity Committee.

Pontypridd.—IMPROVED PUBLIC LIGHTING.—A new system of street lighting is to be commenced at the end of this month and completed by about the middle of January next year. Along the Cardiff-Merthyr Road, Nantgarw, the lighting of the dual carriageways will be by 400-W "Osira" fluorescent lamps in "Di-fractor" lanterns and mounted on G.E.C. concrete columns. The spacing will be 150 ft. and the mounting height 25 ft. from the roadway. Each carriageway will be treated as a separate road. The Council's Electricity and Transport Department will lay the cables, the installation being directed by Mr. G. J. Evans, the electrical and transport engineer.

Renfrew.—ROAD LIGHTING.—The Town Council, after a conference with the architect of Scottish Industrial Estates, Ltd., and a representative of the Clyde Valley Electrical Power Co., has decided to ask the Clyde Valley Co. to prepare a scheme of lighting the roads at the Industrial Estates.

Ripponden.—DISCHARGE LIGHTING.—Sodium electric discharge lighting has been adopted in the centre of the district, and was inaugurated on November 2nd.

Rushden (Northants).—ELECTRIC PUMPING.—Equipment for electric pumping is to be installed at Sywell waterworks at a cost of £435 to replace obsolete gas plant.

South Shields.—ESTIMATED EXPENDITURE.—Estimates in the Electricity Committee's five years' plan include: £2,400 for mains and services; £5,000 for meters; £2,468 for the Holborn sub-station; £5,500 for switchgear; £10,000 for mains; and £1,100 for sub-stations.

LOAN.—Application is being made by the Town Council for sanction to borrow £12,872 for mains and services.

Stockport.—STREET LIGHTING COMPARISON.—Quotations submitted to the Capital Borrowings Sub-Committee of the Finance Committee recently show that based on one mile of roadway illuminated at 6,000 lumens per 100 sq. ft. of roadway the

capital cost of lighting the main roads in the town would be £16,111 by electricity as compared with £21,922 by gas, while the annual maintenance cost would be £4,113 by electricity against £10,575 by gas. The respective output of light would be 7,432,000 lumens by electricity and 5,430,000 lumens by gas.

FREE ELECTRICITY SUPPLY FOR SHOPPING WEEK.—The Electricity Committee has offered to advise shopkeepers on outside lighting schemes in connection with a proposed Shopping Week in the town, and to provide a free supply for outside lighting, subject to a charge of 5s. for connection and disconnection.

Tynemouth.—EXPENDITURE ON METERS.—The borough electrical engineer has stated that the undertaking will have to spend £38,000 on replacing 9,000 meters which do not comply with the Electricity Supply Meters Act, 1936, which came into force in July.

Uxbridge.—PROPOSED TRANSFER OF PURCHASE RIGHTS.—An inquiry is to be held by the Electricity Commissioners on December 12th with regard to a draft Order which they have made altering the London & Home Counties Electricity District Order, 1925, providing, *inter alia*, for the transfer to the Joint Electricity Authority of the purchase rights of local authorities in the area covered by the Uxbridge & District Electricity Supply Orders, 1900 to 1906, as amended by the North Metropolitan Electric Power Supply Act, 1937, and for the representation of the local authorities in the area upon the Joint Electricity Authority. Any representations or objections with regard to the Order must be sent in writing to the Secretary of the Electricity Commission not later than December 5th. The Uxbridge Orders are at present held by the Uxbridge & District Electric Supply Co., Ltd., and cover an area of about 80 sq. miles with a population estimated at 165,000. The company has an issued capital of £1,230,000 (all in ordinary shares), and has paid an 8 per cent. (tax-free) dividend on its capital for the past two years. It takes a bulk supply from the Metropolitan Electric Supply Co., Ltd.

Wallsend.—CABLES.—The Town Council has approved plans by the North-Eastern Supply Co., Ltd., for underground cables in Elton Street West and Brussels Road.

A part of the reconstructed showrooms of Southport Corporation Electricity Department **(See page 696)**

Willingdon (Sussex).—STREET LIGHTING SCHEME.—As the result of a public inquiry on September 16th the Minister of Health has granted powers for the introduction of a street lighting scheme.

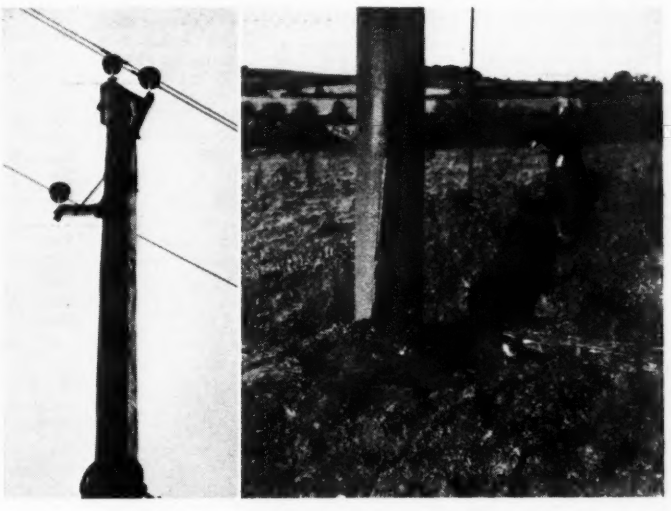
York.—POWER STATION EXTENSIONS.—The Electricity Commissioners have consented to the extension of the York generating station, and the Electricity Committee recommends the engagement of L. G. Mouchel & Partners as consulting engineers in connection with the construction of the proposed new cooling tower.

Overseas

Australia.—POWER STATION EXTENSIONS.—Large additions to the Newport (Victoria) power station will be needed shortly in order to meet the power requirements of the Melbourne suburban electric railways, states our Australian Correspondent. A sum of £1,000,000 is to be spent over a period of several years, and tenders have already been called for the provision of a 30,000-kW turbo-generator and boilers.

Holland.—SUPPLY LEGISLATION.—A new electricity supply law has been passed by the First Chamber. It provides for the formation of a board for the control of the industry, and the Government is given extensive powers.

Northern Ireland.—RESULTS OF A HIGH-VOLTAGE LINE FAULT.—Unusual effects resulted from the breakage of binding wire on an overhead line, designed for 11 kV but operated at 6.6 kV, when one of the conductors (the left in the photograph) made contact with the insulation pin. The steel earth-wire running down the pole melted and the pole was almost burned through at ground level. Local heating caused a jet of steam to rise from the wet ground about 2 ft. from the base of the pole, just as if an underground steam-pipe had burst. A peculiar feature was the almost complete absence of burning on the conductor, the only result being a slight pitting of the copper.



The cause of fault and, right, the effect

It is presumed that the steel earth-wire was broken at ground level before the occurrence of the fault or failed at the first surge. A correspondent who sent us the above information suggests that the occurrence of faults of this type make it advisable to have two earth-wires on all high-voltage poles as standard practice.

NEW PLANT AT BELFAST.—A new Metro-Vick 30,000-kW turbo-alternator was recently put into commission at the Harbour power station, Belfast. Ald. M'Kinney, chairman of the Electricity Committee, said that the unit, together with its foundations for buildings had cost £150,000. Two years ago, on a similar occasion, he predicted that, as a result of the economies which the first 30,000 kW generating set would effect, the Committee would probably be in a position to reduce the charges for supplies to consumers, despite the increasing cost of coal. Since that time there had been concessions totalling £23,700 per annum, and he predicted that when the present machine had had the opportunity of proving its efficiency the Committee would be placed in the position of being able to give further favourable consideration to those who used electricity for power purposes. The Committee's foresight in placing the orders for the present installation before the completion of the last extension had resulted in a considerable saving in capital costs, as the price of plant rose just after the orders had been placed. The city electrical engineer, Mr. F. H. Whysall, and his staff were already considering schemes for additional extensions to meet anticipated development. Mr. J. S. Peck, of the Metropolitan-Vickers Electrical Co., Ltd., on behalf of the contractors, presented a memento to the Lady Mayoress (Lady M'Cullagh, C.B.E.), who performed the official starting ceremony and unveiled a tablet bearing the name of her husband, Sir Crawford M'Cullagh.

Russia.—POWER STATIONS IN THE ARCTIC.—A Government Commission has taken over the first hydro-electric station beyond the Arctic Circle, on the River Neva, to be known as the Nevages II, states *Reuter's Trade Service* from Moscow. It has a capacity of 60,000 kW. Another station, the Nevages III, with a power of 150,000 kW, is now being built.

A HUGE GENERATOR.—It is reported in a recent issue of *Industria* that engineers of the Electrosila Works in Leningrad are designing a 250,000 kW hydro-electric generator which is to be installed at Kuibyshev.

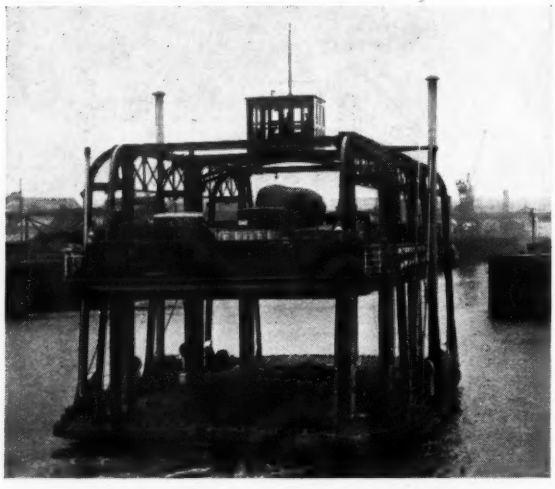
Tasmania.—FURTHER EXTENSIONS AT TARRALEAH.—Our Australian Correspondent reports that with the first section of the Tarraleah hydro-electric scheme in full operation preparations are now being made for construction work which will duplicate this scheme. A dam will be constructed at Butler's Gorge, and two diamond drilling plants are at present making tests of rock in order that the site of the dam may be decided upon.

United States.—A HYDROGEN-COOLED ALTERNATOR.—An 80,000-kW 1,800-RPM turbo-alternator recently ordered by the Niagara Hudson Power Co. for the new Oswego power station, of the Central New York Power Corporation, is said by the *Electrical World* to be the largest steam set contemplated since 1931. Steam conditions at the stop valve will be 1,250 lb. per sq. in. and 900 deg. F., and the turbine will be the first large condensing unit for that pressure to be built in a single casing. The 13.8-kV alternator is to be cooled by hydrogen. It is anticipated that the coal consumption under full load will be 0.85 lb. per kWh.

Traction

Grimsby.—JOINT TRANSPORT BOARD PROPOSED.—A sub-committee has been appointed to consider the formation of a Joint Transport Board for the Grimsby and Cleethorpes undertakings. There are at the moment several joint services.

London.—CENTRAL LINE EXTENSION.—The westward extension of the tube which is being built at a cost of £2,500,000 by the G.W.R. and over which will be extended the Central London Railway services eight miles from North Acton to Ruislip, is rapidly taking shape. Already the steam trains have been diverted to new tracks between Wood Lane and North Acton, thus giving margin for a more frequent service of electric trains. At Hanger Lane, Perivale and Greenford the foundations have been prepared for the new station buildings on which work will be commenced in the new year.



The new Diesel-electric ferryboat of the Clyde Navigation Trustees equipped with G.E.C. electric propulsion and auxiliary equipment

Merthyr.—TRAMS TO BE ABANDONED.—After two years agreement has been reached between the Merthyr Electric Traction Co. and the Corporation regarding the abandonment of the trams so that the Corporation may operate a bus service over the present tramway route.

South Africa.—NEW ELECTRIFICATION.—Conversion work is now actively proceeding on the 23-mile railway between Rossburgh and Hillcrest, in the neighbourhood of Durban, and when this is completed the electrified route mileage of the South African Railways will have risen to over 600, all on the 3,000-V DC system except the Capetown suburban system, which is operated at 1,500 V DC.

Communications

Great Britain.—TALKING CLOCK.—The talking clock telephone service ("TIM") is to be extended to Birmingham, Bristol, Leeds, Nottingham, Swansea, Leicester, Sheffield, Plymouth and Newcastle.

India.—BOMBAY RADIO STUDIOS.—It is stated that the five studios being built at the Bombay Radio Station will be the finest so far constructed in India. Experiments with various sound-absorbing materials carried out by the Research Department of All India Radio have proved that a type of vegetable fibre board, mounted in a special manner on the walls, gives the desired acoustic properties. Semi-indirect illumination will provide an even distribution of light with a minimum of glare. The whole studio block, covering a floor area of 7,000 sq. ft., will be air-conditioned to give maximum comfort, and an inside room temperature of 82 F. at 50 per cent. humidity will be maintained throughout the year, irrespective of weather conditions outside. The studios are expected to be ready for regular use by the middle of this month.

Italy.—POWERFUL NEW SHORT-WAVE TRANSMITTER.—On October 31st the Italian Broadcasting Company (Ente Italiano Audizioni Radiofoniche) put into service at Prato Smeraldo, near Rome, a 100-kW short-wave transmitter. This is the highest powered short-wave broadcaster which has yet been installed, and the first which will give world-wide radio service. The equipment, which was constructed in the Milan factory of Fabbrica Apparecchiature per Comunicazioni Elettriche, was designed, manufactured and installed within eighteen months, a remarkably short time considering the development work which had to be undertaken. The transmitter has special circuits for the power amplifiers, which are said to give it a much higher performance than ever before obtained for short-wave broadcasting, with a quality which is better than that of most medium-wave stations. Facilities are provided to vary the wavelengths in a few minutes to meet changing atmospheric conditions. This can be accomplished because the circuits for the high-power stages are built on a rotating turntable.

Birmingham Electricity Failure

Joint Statement

A STATEMENT regarding the interruption of the electricity supply in Birmingham on Friday last has been issued by the Birmingham Corporation Electricity Department and the Central Electricity Board, following discussions which have taken place between Mr. F. Forrest (chief engineer and manager, Birmingham) and Mr. Johnstone Wright (chief engineer, C.E.B.). In this it is stated that the original cause of the trouble was a flashover at 5.15 p.m. on the bushing of a transformer at the Board's sub-station due to dirt deposit. This transformer was temporarily running with overload protection owing to maintenance requirements, and this no doubt made the fault more severe than it otherwise would have been. In accordance with the routine practice the insulators in the grid sub-station had been cleaned a few days previously. This practice has been found under normal conditions to provide the requisite margin of safety.

Atmospheric conditions on November 4th were exceptionally bad resulting in the discharge from the chimneys falling more than usual, with detrimental effect on insulation at the grid sub-station. This was aggravated by a rather poor grade of coal being used on that day on the stoker-fired boilers which are fitted with cyclone dust catchers. This dust question is not a new one at Hams Hall, and some three years ago it was tackled energetically by the Corporation and the C.E.B. The Corporation, at considerable expense, installed precipitators on the pulverised-fuel boilers, and the C.E.B. completely re-insulated the bus-bars with fog-type insulators and installed h.p. equipment for water washing the insulators. Since then the atmosphere around Hams Hall has been particularly free from pollution, and it was thought that the difficulties had been completely overcome. Dust created by the unloading of low-grade fuel may also have contributed to the deposit on the sub-station equipment.

Hams Hall Auxiliaries Disorganised

The protective gear on the grid circuits operated correctly to isolate the fault and left the two generating stations, Hams Hall and Nechells, interconnected carrying the local load, the remainder of the grid supplies being unaffected. The supplies to the auxiliaries in Hams Hall were, however, disorganised by the severity of the fault, so that the requisite output could not be maintained. Efforts were made to restore normal generation, but ultimately it became advisable to isolate Nechells station from Hams Hall and thus enable Nechells to maintain its section of the Birmingham load without interruption. The part of the Birmingham load supplied from the Board's Bartley Green sub-station was also unaffected. It became necessary, however, due to the position at Hams Hall, to switch out the section of the Birmingham load supplied from that station. The restoration of these supplies, from the extensive Birmingham network, involved a large number of switching operations and it was about 7.15 p.m. before conditions were completely normal.

As a result of the foregoing, the following arrangements will be adopted in future:—(1) More frequent washing of insulators and bushings at the sub-station during abnormal atmospheric conditions, the burning of low-grade fuel on the stoker-fired boilers and the unloading of such fuel. (2) During abnormal maintenance conditions any temporary overload settings of switches at the Board's sub-station will be kept low. These switches are normally on sensitive leakage protection. (3) The Corporation will consider the question of modifications to the arrangement of the auxiliary supplies within Hams Hall generating station, with a view to avoiding the disorganisation which might arise from a severe fault, whether on the grid, in the station itself, or on its distributing system. (4) The Corporation will also consider means for preventing the dispersal of dust arising from the unloading of low-grade fuel.

Wolverhampton Street Lighting Conference

MAJOR SIR CHARLES A. MANDER, Bt., was to take the chair at an E.D.A.-E.L.M.A. Street Lighting Conference at the Civic Hall, Wolverhampton, on November 10th. Invitations were sent to all mayors, chairmen of Councils, members of Lighting Committees, town clerks and surveyors throughout Staffordshire, Shropshire, Worcestershire, Warwickshire, and parts of Leicestershire, Derbyshire and Hertfordshire. Mr. N. L. Harris was to outline the development of electric filament and discharge lamps, and a talking film, "Modern Street Lighting," was to be introduced by Mr. R. Maxted and a large variety of electric street lighting lanterns in working condition were to be inspected.

Following the film there was to be a general discussion on economic and administrative problems arising in connection with street lighting. In the evening several representative street lighting installations in Wolverhampton and Walsall were inspected.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Superheater Co., Ltd.—Private company. Registered October 31st. Nominal capital, £100. Objects: To adopt an agreement with Marine and Locomotive Superheaters, Ltd., for the acquisition of the business carried on by that company and the property and assets comprised therein; to acquire patents for any invention relating to the generation, use and application of superheated steam for locomotives, marine and stationary boilers, and other types of heat exchangers, and to carry on the business of mechanical, railway, hydraulic, constructional, marine, water, electrical, aircraft, automobile, transport and general engineers, &c. The directors are: H. W. Lee, Reinden Wood, Hawkinge, Folkestone (managing director of J. Stone & Co., Ltd.); A. L. McColl, Bemersyde, Oakleigh Park North, N.20 (chairman of Vacuum Oil Co., Ltd.); C. E. Adams, 87, Lexham Gardens, Kensington, W.8; G. L. Bourne, 60, East 42nd Street, New York (chairman of Superheater Co., New York); F. R. Fitzpatrick, 60, East 42nd Street, New York (engineer, the Superheater Co., New York); R. S. Portham, 73, Park Mansions, Knightsbridge, S.W.1; and E. A. Robinson, 85, New Cavendish Street, W.1. Secretary: H. Melhuish. Registered office: Bush House, Aldwych, W.C.2.

Thompson Ritchie & Co., Ltd.—Private company. Registered November 2nd. Capital, £1,000. Objects: To acquire the business of an electrical engineer and contractor carried on by F. H. Wheeler as Thompson Ritchie & Co. at 39, Victoria Street, Westminster. The directors are: Hon. R. W. Morgan-Grenville, Hammerwood House, Midhurst, Sussex; F. H. Wheeler, 35, Cheyne Place, S.W.1; and J. G. Lippett, 97, Oakwood Park Road, Southgate, N.14. Secretary: C. R. H. Smith. Registered office: 39, Victoria Street, Westminster, S.W.1.

D. Joseph, Ltd.—Private company. Registered October 26th. Capital, £2,000. Objects: To carry on the business of buyers and sellers, importers and exporters of electric incandescent lamps, bulbs and accessories, &c. The subscribers are: J. Hockman, C.A., 46/7, Cheapside, E.C.2; and P. Hockman, 10, Durley Road, N.16. D. Joseph is permanent governing director. Registered office: Universal House, 23, Rochdale Road, Manchester, 4.

Metro Manufacturing Co., Ltd.—Private company. Registered October 31st. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in wireless receivers, &c. The permanent directors are: A. F. Childs, 17, Parkfield Avenue, Hillingdon, Middlesex; and A. W. Baxter, 22, Somerset Way, Iver, Bucks. Registered office: Albert Works, Spencer Road, N.8.

Alfred Owen and Co., Ltd.—Private company. Registered November 2nd. Capital, £5,000. Objects: To carry on the business of manufacturers of and dealers in electrical insulated wires, cables, flexible materials and bobbins and insulated materials of all kinds, electrical and radio accessories, &c. The permanent directors are: W. A. S. Owen, 17, Oakington Avenue, Wembley Park, Mdx., and F. C. Langton, 66, Lake View, Canons Park, Edgware. Secretary: W. A. S. Owen.

Relay Controls, Ltd.—Private company. Registered November 2nd. Capital, £100. Objects: To carry on the business of constructors of and dealers in wireless and electrical radio and other apparatus; to carry on, establish, conduct, control and manage, in the U.K. or elsewhere, radio relay services of the broadcast radio programmes (including such other matter as may be permitted by the Postmaster-General). The directors are: J. C. Charles, 15, Castle Street, Tredegar, Mon., and four others. Secretary: A. D. Thomas. Registered office: 12, Windsor Place, Cardiff.

Fuller's (Radio & Television), Ltd.—Private company. Registered November 5th. Capital, £1,000. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus, accessories and components and in particular radio sets, valves, radio and other gramophones, television sets, &c. The directors are: L. Bell and Mrs. M. Bell, both of 124, London Road, King's Lynn. Secretary: C. R. Smith. Lloyd's Bank Chambers, Peterborough. Registered office: 124, London Road, King's Lynn.

A Arc (1938), Ltd.—Private company. Registered November 5th. Capital, £100. Objects: To carry on the business of engineers in all its branches (including electrical, mechanical, chemical and general engineers), manufacturers and merchants of electrodes, electric and other forms of welding and soldering, &c. The directors are: F. F. H. Schroeder (chairman), Holne Chase, Hampstead Golf Course, N.2; and W. Manson, 22, Lonsdale Road, Barnes, S.W.13. Registered office: 22, Lonsdale Road, S.W.13.

Returns of Electrical Companies

Statements of Capital

Shoreham and District Electric Lighting & Power Co., Ltd.—Capital, £200,000 in £1 shares. Return dated June 8th, 1938. 125,000 shares taken up. £118,500 paid. £6,500 considered as paid. Mortgages and charges, nil.

British Electric Meters, Ltd.—Capital, £50,000 in £1 shares Return dated August 3rd, 1938. 35,600 shares taken up. £28,250 paid. £7,350 considered as paid. Mortgages and charges, nil.

Public Utilities (Electric), Ltd.—Capital, £25,000 in £1 shares. Return dated June 23rd, 1938. All shares taken up. £25,000 paid. Mortgages and charges, nil.

Patterson Lamps, Ltd.—Capital, £10,000 in 10,000 ordinary shares of £1 each. Return dated September 9th, 1938. 6,330 shares taken up. £6,330 paid. Mortgages and charges, nil.

W. Sisson and Co., Ltd.—Capital, £50,000 in 38,000 ordinary and 5,000 preference and 7,000 deferred shares of £1. Return dated June 22nd, 1938. 31,711 ordinary and 4,375 preference and 7,000 deferred shares taken up. £28,686 paid on 24,311 ordinary and 4,375 preference shares. £14,400 considered as paid on the remainder. Mortgages and charges, nil.

Mortgages and Charges

Brush Electrical Engineering Co., Ltd.—Particulars have been filed of debenture stock to secure £150,000, together with a premium on redemption in certain events varying from one to five per cent., authorised October 14th, 1938, and covered by trust deed of same date, constituting a first specific legal charge on freehold and leasehold properties in Loughborough, and a first floating charge on the company's other assets, present and future, including uncalled capital. The whole amount is now issued. Trustees: Atlas Assurance Company, Ltd.

Thomas Jones & Sons (Walthamstow), Ltd.—Charge on 20, High Street, Walthamstow, E., dated October 6th, 1938, to secure £100. Holder: C. S. Watson, Lloyds Bank Chambers, Church Hill, Walthamstow.

Edwards & Marshall, Ltd.—Particulars filed of £2,000 debentures, authorised October 18th, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

R. Darbyshire, Ltd.—Further charge on properties in Talbot Road and Upper Talbot Street, Blackpool, dated October 26th, 1938, to secure £500. Holder: C. Walsh, "Ormonde," Bispham Road, Carleton, Blackpool.

Hume Atkins & Co., Ltd.—Mortgage on leasehold lands and factory in Icknield Way, Letchworth, dated October 6th, 1938, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Vaughan Martin, Ltd.—Satisfaction to the extent of £500 on July 28th and £500 on September 26th, 1938, of debentures dated January 5th, 1938, and registered January 21st, 1938, securing £1,000.

Isle of Wight Electric Light & Power Co., Ltd.—Satisfaction in full on August 11th, 1938, of trust deed dated August 21st, 1903, and acknowledgments of indebtedness dated July 25th, 1905, and October 28th, 1907, and registered September 10th, 1903, July 28th, 1905, and November 11th, 1907, respectively securing debenture stock.

Reports and Dividends

J. A. Crabtree & Co., Ltd., the operating subsidiary of Crabtree Electrical Industries, Ltd., reports a net trading profit of £169,149 for the year to July 31st, against £200,147 in the preceding year, to which is added other income making £171,743 (against £201,539). After providing for depreciation, plant expenditure, and tax, &c., the balance available is £101,244, to which is added £51,034 brought in. It is proposed to place £7,000 to reserve, to pay dividends totalling £92,500, and to carry forward £52,777. The net revenue of the parent company for the year to October 31st is £91,204, as compared with £103,084 for the first period from November 21st, 1936, to October 31st, 1937. Including £17,396 brought in the balance available is £108,600. The total distribution for the year is maintained at 17½ per cent., including 7½ per cent. bonus, and the amount carried forward is £18,819.

S. Smith & Sons (Motor Accessories), Ltd., reports a trading profit for the year ended July 30th of £360,645, as compared with £340,905 for 1936-37, to which is added other income making £363,319. After providing for depreciation, directors' fees and income tax, the net profit is £220,493 (against £250,385). The preferred dividend is maintained at 14 per cent. for the year and the deferred dividend at 50 per cent. Reserve receives £25,000, to writing off patents £10,000, research account £27,000, and £82,291 is carried forward (against £86,371 brought in).

Heenan & Froude, Ltd., report a profit for the year ended August 31st of £46,891, as compared with £35,524 in the preceding year. After providing for taxes and staff fund, it is proposed to pay a final dividend of 5 per cent., making 10 per cent. for the year (same), plus a bonus of 2½ per cent., to place £13,828 to general reserve, and to carry forward £16,520.

The Metropolitan Electric Supply Co., Ltd., has placed privately a further £750,000 3 per cent. debenture stock which was on the market on Wednesday at about 87 free of stamp and fee. This new stock will be transferable temporarily in the form of provisional scrip with a coupon attached for approximately 6s. per cent., payable on January 1st, 1939. After that date the stock will rank *pari passu* with the £1,000,000 3 per cent. debenture stock already in issue.

The Electrical Finance & Securities Co., Ltd., proposes to increase the capital from £500,000 to £525,000 by the creation of 25,000 £1 ordinary shares. These shares, together with 75,000 unissued shares, are to be offered to existing shareholders on terms to be decided later. The funds are required to repay a bank overdraft and to meet the expenses of the company's expansion. A meeting to consider the capital increase proposal will be held on November 17th.

Ensign Lamps, Ltd.—Presiding at the annual meeting held on November 4th Mr. H. Burroughes (chairman) said that contrary to expectations the trading account under review had not benefited by the new works owing to delays in completion due to circumstances beyond their control. There was every reason to believe, however, that the new works, now completed, would assist them in showing a further improvement in next year's figures. The sales of both Ensign and Ribble lamps had again increased substantially during the first three months of the current financial year, as compared with the sales of the corresponding period of last year. The increased

production of the new factory was now enabling them to meet the heavier demand, and in this connection they were helped considerably by having followed their usual practice of building up reserve stocks during the summer months.

Electric & Musical Industries, Ltd., reports a total profit for the year ended September 30th of £239,429, as compared with £473,413 in the preceding year, and after providing for general expenses, directors' fees and income tax, the earnings available for dividends are £146,496 (against £313,964). The dividend on the ordinary capital is 5 per cent. (against 10 per cent.), and £298,418 is carried forward, as compared with £277,334 brought in. Meeting: November 18th.

The Cape Electric Tramways, Ltd., reports a profit for the year ended June 30th of £30,724, and after deducting debenture interest, &c., and adding debenture interest recovered from subsidiary companies (£10,532), there is a net profit of £29,182 (against £25,714), to which is added £67,707 brought forward. When the dividend declared at the last meeting (£24,561) is deducted there is a balance available of £72,328. The dividend for the year is maintained at 5 per cent. The directors state that having regard to the amount of money which is being spent on development and modernisation of services in Cape Town and Port Elizabeth it is wise to conserve the company's cash resources so far as is reasonably possible.

The Para Telephone Co. reports a net profit for 1937 of £3,630 as compared with £2,989 in the preceding year, and after providing for depreciation and amortisation of capital expenditure of £3,528, and adding £160 brought in, there is a balance of £262 which is carried forward.

The British Electric Resistance Co., Ltd.—Application has been made this week to the Committee of the London Stock Exchange for permission to deal in the company's 2s. ordinary shares. The issued capital is £50,000.

The Electrolux Corporation (U.S.) has announced a quarterly dividend of 40 cents per share (same last year, plus an extra dividend of 30 cents).

The Delhi Electric Supply & Traction Co., Ltd., is maintaining its interim dividend at 4 per cent., tax free.

The Ebonite Container Co., Ltd., is paying an interim dividend of 3 per cent., less tax (against 4 per cent.).

Sydney S. Bird & Sons, Ltd., have declared a final dividend of 12½ per cent., less tax, making 17½ per cent. for the year (against 25 per cent. for the period November 18th, 1936, the date of incorporation, to September 30th, 1937, equivalent to over 28½ per cent. per annum).

The Madras Electric Supply Corporation, Ltd., has placed privately at par 100,000 4½ per cent. notes redeemable at par on October 1st, 1948.

Ward & Goldstone, Ltd., have declared an interim dividend on the ordinary shares at the rate of 10 per cent. per annum less tax.

The Telephone Manufacturing Co., Ltd., is paying an interim dividend of 2½ per cent., less tax (same).

Stocks and Shares

TUESDAY EVENING.

THE new session of Parliament which starts to-day—Tuesday—is faced with a very heavy programme of legislation, and it is doubtful whether the Government will find time to deal with the proposals affecting electricity which it has promised. From the material point of view of Stock Exchange prices, it is not expected that Government action will exert any direct influence over quotations, but any proposals will be watched with keen interest by everyone connected with the financial aspects of electricity.

Stock Exchange business as a whole is running on lines of almost mid-summer quietude, from which the continued vague uncertainty in regard to foreign politics is in the main responsible. The unemployment figures published early this week were regarded as satisfactory. On the other hand, the Home Railways traffics continue to make a lamentable showing. Trade pointers and captains of industry suggest that trade is gradually recovering from its recession.

The American industrial position has taken a dramatic turn for the better during the past few weeks, with the result that American utility stocks and shares have been a buoyant market. Whatever may be the result of the Congressional Elections in the United States this week, the future is regarded with a hopefulness for which there is obviously good ground. Prices of British stocks and shares are now but little affected by the progress of events in America. It is assumed, however, that the rising tide of industry on the other side of the Atlantic will bring with it a wave of increased activity in the commodity and metal markets.

Gilt-edged Steadiness

The tenor of the Parliamentary debates appears to have lightened the gilt-edged market's spirits. War Loan is again treading closely upon the heels of par. Central Electricity stocks have yet to respond. A move against the trend by London Transport Board issues seems to be a belated reaction to the rather grim annual report. Generally speaking, the atmosphere has become more cheerful. Intentions to bring the Anglo-Italian pact into play have helped to induce a better feeling in regard to the foreign political outlook. At the same time, the Parliamentary speeches dealing with rearmament left an impression that there may be no call for Government borrowing on so vast a scale as had been in people's minds immediately after the scare of six weeks back.

Transit of Prices

It was about two years ago from now that industrial ordinary share prices began to topple over the summit of the boom. Comparing average prices then ruling with those of to-day, the statisticians calculate that quotations have dropped during the period time by about 6s. 8d. in the £. Leaving out of account the crisis fall towards the end of last September, the figures suggest that the decline had spent most of its force by March of this year. The present level is on a par with that month, and in the meantime there has been a modest start towards a recovery. As a matter of interest, it may be observed that most ordinary shares are standing now almost exactly where they did a few days after the agreement on Czechoslovakia. The levelling-out of prices—except during the days of the scare—has set people wondering whether permanent recovery is on its way. There is a feeling that shares now stand, in any case, at reasonable figures, and that to-day's prices will be looking cheap before many weeks have passed.

Home Railway Issues

London Passenger Transport issues are dull for the reason mentioned in the second paragraph above. That "something will have to be done," as the vague saying goes, for the reinstatement of the earning capacity of the home railway companies, is painfully apparent. Presumably a fare-raising policy is under discussion. There are many anomalies to be found under the present scales of charges, and some of these could be rectified without much risk of complaint on the part of passengers. In a comprehensive rearrangement of fares, the anomalies would doubtless disappear. Tilling shares are 1/6 harder at 45s. British Electric Traction preferred and deferred stocks are quoted ex dividend without quotable changes having been made in the official prices.

Industrial Markets

Industrial markets found, no less than the gilt-edged section, a measure of relief in the Parliamentary announcements. Uneasiness had been felt on account of the possibility of industry being "mobilised" in some way or other which would lead to serious dislocation of everyday business. Opinion is now being led towards a conclusion that industry can produce all that is necessary—and with reasonable promptitude—without the imposition of wartime discipline. Steel and engineering shares have continued to be the most active section. Stock has been coming forward rather more freely at the higher prices, with the result that quotations are not greatly changed on balance.

Electrical equipment shares are subject to these influences, English Electrics, now 31s. 6d., are among the few to have made appreciable headway. Of the smaller companies, British Thermostat shares continue to advance, and are now up to 15s., as compared with only 11s. 3d. a fortnight ago. Lancashire Dynamos at 60s. are another good spot. Westinghouse Brakes have had a fresh rise from 54s. to 56s., on reports of the company having secured large contracts. An advance of 7s. 6d. to 4¾ in Consolidated Signals is a natural sequel, the company being largely interested in the Westinghouse concern. International Combustions, at 5⅜, have added 5s. to the previous week's advance of half a crown. Profits of Crabtree Electrical for the year ended in July are below the previous figures, but sufficient to cover a 17½ per cent. dividend for the second year in succession. At 25s. the shares are 1s. 3d. to the good and give a yield of 7 per cent.

"Emmies" Results

The full accounts in the Electrical and Musical Industries report were considered to put a better complexion upon the year's results than had been indicated by the preliminary figures. Nevertheless, the price of the shares drooped to 11s. 3d. Net profits are shown to have fallen by more than 50 per cent. After the preference dividend has been paid the earnings are equal to little more than 2 per cent. on the ordinary capital, against 5 per cent. actually distributed. Last year the dividend was 10 per cent. and earnings were equivalent to 13¾ per cent. Apart from a reference to depressed conditions at home and abroad, the report is not informative about the past year's difficulties or the future outlook. The annual meetings, however, seldom fail to satisfy the members' thirst for information as to how matters are moving for the company's varied interests. A yield of less than 4½ per cent. on the shares shows plenty of confidence in the company's powers of recuperation.

Electricity Supply Yields

Prices in the market for home electricity supply shares have settled down, for the time being, at a level which gives the buyer an average return of about 4½ per cent. South Londons and County of Londons both give a yield in that neighbourhood. City of Londons pay better, the return being 4¾ per cent., and the Metropolitans now show one of the highest yields in the list, at over 5 per cent. Other comparatively high-yielding shares are those of the holding companies, Electric Finance and Securities and British Power and Light. At the other end of the scale, Yorkshire Electrics return a round 4 per cent. on the money. Yields on overseas companies' shares are generally higher. Those of the big Indian undertakings, for instance, give between 5 and 5½ per cent. Jerusalem Electrics afford 5 per cent., and Palestines half a crown per cent. less—but free of tax. Perak Hydros pay 6 per cent. on the money. East African Power and Kalgoorlie Electrics give yields of 6¾ and 7¼ per cent. respectively.

Electrical Companies' Shares

Prices, dividends and yields

Company.	1938. Highest.	1938. Lowest.	Dividend. Previous.	Dividend. Last.	Price Nov. 8.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.							
Bournemouth and Poole	68/3	62/–	15	15	67/6	—	4 8 7
British Power & Light	30/9	24/6	6	7	28/6	—	4 18 3
City of London	34/6	28/6	7½	7½	31/6	—	4 15 3
Clyde Valley	42/6	33/–	8	8	35/9	—	4 9 4
County of London Edmundson's:	51/9	38/9	10½	10½	46/6	+6d.	4 10 5
7% Pref.	33/3	30/–	7	7	31/3	—	4 9 6
Ord.	40/9	18/9	9	9	26/–	—	—
Elec. Dis. Yorkshire	43/6	37/9	9	9	41/3	—	4 7 5
Elec. Fin. and Securities	51/9	49/–	12½	12½	50/–	—	5 0 0
Elec. Supply Corporation	55/–	50/–	12	12	53/9	—	4 9 5
Isle of Thanet	21/3	18/6	4	4	20/–	—	4 0 0
Lancs Light and Power	35/–	26/–	7½	7½	31/3	—	4 16 0
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric	32/9	28/–	7	7	30/9	—	4 11 4
London Electric	36/3	32/–	8	10	34/–	—	4 2 4
London Power Deb. Red.	108¾	100	5	5	105	—	4 15 3
Metropolitan	51/–	41/–	10	12	47/6	—	5 1 1
Midland Counties	39/9	33/–	8	8	36/3	—	4 4 3
Mid. Elec. Power	41/9	37/–	8	9	40/–	—	4 10 0
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4 17 4
North Eastern Electric:							
Ordinary	34/–	25/–	7	7	31/–	—	4 10 6
7% Pref.	34/–	30/–	7	7	32/–	—	4 7 6
Northampton	47/6	43/9	10	10	46/3	—	4 6 7
Notting Hill 6% Pref. (£10)	14	13½	6	6	14½	+1	4 2 9
North Met. Elec.:							
Ordinary	49/–	43/–	10	10	46/3	—	4 6 7
6% Pref.	30/6	28/3	6	6	29/6	—	4 1 4
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	36/3	—	4 8 2
Southern Areas	22/9	18/6	4½	5	21/3xd.	+3d.	4 14 1
South London	32/6	31/–	7	7	31/6	—	4 9 0
West Devon	23/3	21/3	5	5	1½	—	4 9 0
West Glos.	19/–	16/9	2	2	18/–	—	2 4 5
Yorkshire Elec.	42/–	36/9	8	8	40/–	—	4 0 0
Overseas Electricity Companies.							
Atlas Elec.	4/6	2/6	Nil	Nil	3/–	—	—
Calcutta Elec.	44/3	36/3	12*	10*	2	--	5 0 0
Cawnpore Elec.	40/–	35/–	10	10	36/3	—	5 10 6
East African Power	28/3	22/6	7	7	24/–	—	6 16 8
Jerusalem Elec.	26/9	23/3	5	6	24/–	—	5 0 0
Kalgoorlie (10/–)	12/–	9/6	7½	7½	10/3xd.	—	7 6 4
Madras	34/6	28/9	8*	8*	30/–xd.	+6d.	5 6 8
Montreal Power	31¾	26¾	1½	1½	31½	—	—
Palestine Elec. "A"	31/9	27/–	7½*	7½*	30/9	+9d.	4 17 7
Perak Hydro-electric	25/3	17/–	7	6	20/–	—	6 0 0
Shawinigan Power	23½	16½	65cts.	85cts.	21½	—	—
Tokyo Elec. 6%	65½	39	6	6	60	+½	10 0 0
Victoria Falls Power	76/3	55/–	12	13½	70/–	—	3 17 2
Whitehall Investments Pref.	22/3	15/–	7½	7½	17/6	—	8 11 6
Public Boards.							
Central Electricity:							
1950–70	115¾	97	5	5	110½	—	4 10 6
1955–75	118½	100	5	5	113½	—	4 8 1
1951–73	111	95	4½	4½	108½	—	4 3 0
1963–93	101	85	3½	3½	96½	—	3 11 10
London Elec. Trans. Gtd.	93½	88	2½	2½	90½	—	2 15 3
London & Home Counties, 1955–75	112¾	97½	4½	4½	110	—	4 1 10
Lond. Passenger Transport:							
A	119½	110	4½	4½	114½	−1	3 18 7
B	122¾	105	5	5	115½	−1	4 6 7
C	84	68	4½	4	75½	−½	5 6 0
West Midlands Joint Elec., 1948–68	115½	102½	5	5	110½	—	4 10 6
Telegraph and Telephone.							
American Tel. & Tel.	154½	114	9	9	155½	—	5 15 9
Anglo-Am. Tel.:							
Pref.	115½	103	6	6	101½	−2	5 17 8
Def.	28	24	1½	1½	23	—	6 10 5
Anglo-Portuguese	23/6	19/3	8	8	21/3	—	7 10 7
Cable & Wireless:							
5½% Pref.	104	84	4½	5½	87½	−½	6 5 9
Ord.	67¾	36	—	4	42	−2	9 10 6
Income	102½	99	—	—	101	—	3 18 2
Canadian Marconi $1	6/6	3/9	—	Nil	5/3	—	—
Globe Tel. & Tel.:							
Ord.	32/6	27/6	5½*	7½*	26/3	—½	5 14 1
Pref.	27/6	23/9	6	6	26/3	—	4 11 5
Great Northern Tel. (£10)	42½	34/–	20	20	41	—	4 17 7
Marconi-Marine	30/6	21/6	10	7½	23/9	—	6 6 4
Oriental Telephone Ord.	59/3	2½	12*	12*	2¾	—	4 7 3
Radio Corpn.	8	4¾	8	6	9½	—	—
Telephone Props	13/9	11/3	5	6	13/3	—	9 1 2
Telephone Rentals (5/–)	10/–	7/6	5	6	9/3	—	3 4 10
Western Union	34½	17	2½	—	29½	—	—
Traction and Transport.							
Anglo-Arg. Trams:							
First Pref.	11/–	2/6	Nil	Nil	5/–	+⅛	—
4% Inc.	31	8	Nil	Nil	9	+1	—
British Electric Traction:							
Def. Ord.	1060	675	5	5	950xd.	+2	—
Pref. Ord.	175	150	8	8	165xd.	+3	4 17 0
Bristol Trams	45/–	34/3	5	8	2	—	4 0 0
Brazil Traction	14½	7½	70cts.	$1	12½	−¼	—
Calcutta Trams	26/9	21/6	8	8	23/6	—	6 16 2
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	35/–	+⅛	5 14 3
Mexican Light:							
1st Bonds	39	16½	5	5	25	+5	—
Rio 5% Bonds	91	47	5	5	65	—	7 13 9
Southern Rly:							
5% Prefd.	87	48	5	—	54½	−1	—
5% Pref.	116	83	5	5	96½	—	5 3 10
T. Tilling	60/–	36/6	10	10	45/–	+½	4 9 0
Tilling & B.A.	57/–	46/–	6	10	50/–	—	4 0 0
West Riding	46/3	30/6	10	10	32/6	—	—
Equipment and Manufacturing.							
Aron Electricity Ord.	40/3	31/–	15	15	1 11/16	—	8 17 6
Assoc. Elec.:							
Ord.	45/3	32/–	10	10	37/6	—	5 6 8
Pref.	38/9	35/6	8	8	36/6	—	4 7 8
Automatic Telephone & El.	43/–	35/–	5	10	41/3	—	4 17 1
Babcock & Wilcox	44/–	32/6	10	10	37/6	—	5 6 8
British Aluminium Ord.	54/–	40/–	10	12½	53/9	—	4 13 0
British Insulated Ord.	95/9	77/–	20	20	4 7/8	—⅛	4 10 0
British Thermostat (5/–)	15/6	9/–	17½	18½	15/–	+½	6 3 4
British Vacuum Cleaner	35/9	27/6	5	6	28/3	—	4 5 0
Brush Ord.	5/6	4/9	Nil	Nil	4/9	—	—
Callender's	5½	78/6	20	20	4 5/8	—	4 15 8
Chloride Elec. Storage	77/9	61/–	15	20	75/–	—	5 6 8
Consolidated Signal	116/–	75/–	30	36½	4⅞	+⅜	8 0 0
Crabtree (10/–)	29/–	22/–	17½	17½	25/–	+⅛	7 0 0
Crompton Parkinson:							
Ord. (5/–)	32/3	18/9	12½	12½	26/3	—	—
E. K. Cole (5/–)	8/9	4/6	5	10	6/6	—	7 13 10
Elec. & Musical Industries (10/–)	16/3	9/–	10	5	11/3	−9d.	4 9 0
Electric Construction	36/–	31/–	10	12½	32/6	—	7 13 10
Enfield Cable Ord.	5⅛	46/–	25	25	2½	—	—
Electrical Switchgear	26/3	22/6	5	5½	26/3	—	4 3 10
English Electric	31/9	24/6	Nil	10	31/6	+1/–	6 7 0
Ensign Lamps (5/–)	14/3	11/3	—	25	14/0	–3d.	8 18 6
Ericsson Tel.	2 1/16	31/–	25*	25*	2	—	3 2 6
Ever Ready (5/–)	26/3	16/6	45	35	21/6xd.	—	8 2 10
Falk Stadelmann	34/3	27/–	10	10	27/6	—	7 5 6
Ferranti Pref.	27/6	25/6	7	7	27/6	—	5 2 0
G.E.C.:							
Pref.	34/–	31/3	6½	6½	32/6	+⅛	4 0 0
Ord.	79/3	67/–	17½	20	77/–	—	5 4 0
Greenwood & Batley	25/6	19/–	7	15	26/3	—	11 8 6
Hall Telephone (10/–)	24/6	18/3	5	15	20/–	—	7 10 0
Henley's (5/–)	21/–	16/–	15	20	20/–	—	5 0 0
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12½	39/6	—	6 6 7
India-Rubber Pref.	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl. Combustion	5⅝	4¼	5	30	5⅜	+⅛	5 12 0
Ismay Industries (5/–)	6/9	1/3	6	6	1/–	–3d.	—
J. Lucas	57/9	47/6	15	15	57/6	+⅛	5 4 4
Johnson & Phillips	43/9	32/6	10	12½	36/3x	—	6 13 4
Lancashire Dynamo	72/3	53/–	20	25	53/6	+⅛	8 6 8
Laurence Scott (5/–)	12/–	9/–	7	15	11/3	—	6 13 4
London Elec. Wire	35/–	28/3	12	7½	28/9	—	5 4 2
Mather & Platt	49/–	41/3	12	13½	47/–	—	5 15 0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	77/6	+½	5 3 0
Pye Deferred (5/–)	12/–	8/–	5	25	9/6	—	13 3 2
Revo (10/–)	36/3	30/–	12	17½	35/–	—	5 0 0
Reyrolle	62/6	49/–	12½	12½	56/3	—	4 9 0
Siemens Ord.	31/–	20/6	7½	7½	23/9	—	6 6 4
Strand Elec. (5/–)	6/–	4/–	5	10	5/–	+3d.	10 0 0
S. Smith (1/–)	9/9	6/3	37½	50	8/9xd.	+4½d	6 6 0
Switchgear & Cowans (5/–)	19/6	12/6	20	20	14/6	—	6 18 0
Telegraph Condenser (10/–)	18/9	12/–	5	5	12/6	—	4 0 0
Telegraph Construction	2½	36/–	7½	10	2½	—	4 14 1
Telephone Mfg. (5/–)	9/9	7/–	9	9	8/9xd.	—	5 2 10
Tube Investments	89/6	70/–	23¾	23¾	4½	—	5 15 6
Vactric (5/–)	9/9	5/9	10	10	5/–	—	10 0 0
Vickers	27/–	17/6	10	10	24/6	—	4 1 9
Westinghouse Brake	63/9	45/–	15	17½	56/–	+2/–	6 5 0
Walsall Conduits (4/–)	26/–	22/6	—	55	24/–	+9d.	9 3 4
West, Allen (5/–)	5/9	4/6	—	7½	5/9	—	6 10 4

* Dividends are paid free of Income Tax.

New Patents

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

624. "Ikonoscopes, television cathode-ray tubes, and the like." Radio Akt.-Ges. D. S. Loewe. January 11th, 1936. (493543.)

1063. "Moving-contact electric current convertors." Siemens-Schuckertwerke Akt.-Ges. January 13th, 1936. (493721.)

3895. "Electrode boilers, water-heaters and the like." S. A. Williams and F. J. C. Allen. February 9th, 1937. (493759.)

4129. "Thermionic valves." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust and G. F. Brett. February 11th, 1937. (Addition to 467573.) (493614.)

4227. "Chargeable lead-cadmium cell with acid electrolyte." Baron Stephan von Thyssen-Bornemisza. February 12th, 1936. (Cognate applications 4228/37, 4229/37 and 4231/37.) (493694.)

6081. "Transmission and/or reception of electro-magnetic waves." O. Bormann. March 6th, 1936. (493695.)

7076. "Elimination of interference in wireless systems." F. C. P. Henroteau. February 11th, 1937. (493837.)

7445. "Apparatus for measuring electric currents." R. W. Biles and Nalder Bros. & Thompson, Ltd. March 13th, 1937. (493763.)

7799. "Floodlighting devices." M. Abrams and R. J. Dobell. April 17th, 1937. (493840.)

9926. "Electro-deposition of tin." H. R. Priston, A. W. Hohtersall and W. N. Bradshaw. April 7th, 1937. (493701.)

10188. "High-pressure electrical discharge tubes." Quarzlampen Ges. April 9th, 1936. (493706.)

10201. "Time-lag devices for electric switches." C. M. Williamson and Williamson Manufacturing Co., Ltd. April 9th, 1937. (493707.)

10206. "High-frequency electrical apparatus for use in determining the relative velocity of moving bodies." British Thomson-Houston Co., Ltd. April 9th, 1936. (493708.)

10391. "Manufacture of insulating fabrics." British Thomson-Houston Co., Ltd. April 21st, 1936. (493618.)

10466. "Apparatus for use with cathode-ray tubes." Ferranti, Ltd., and I. N. Vaughan-Jones. April 13th, 1937. (493620.)

10485. "Electrical connection for reducing the consumption of energy due to lighting, and electrical accessory for effecting it." J. Schneebalg, E. Flasner and A. Schneebalg. April 13th, 1937. (493621.)

10606. "Method of manufacture of an electric cable." Southern United Telephone Cables, Ltd., W. P. Whitehouse and A. T. C. Moore. April 14th, 1937. (493913.)

10613. "Electrical circuits for producing currents or voltages of desired wave form." Standard Telephones & Cables, Ltd., and B. Newsam. April 14th, 1937. (Addition to 453887.) (493843.)

10636. "Signalling systems such as public-address systems or the like." Guided Radio Corporation. May 28th, 1936. (493846.)

10725. "Electro-pneumatic brakes." Westinghouse Brake & Signal Co., Ltd. May 12th, 1936. (493853.)

10764. "Electric oscillatory power supply circuits." British Thomson-Houston Co., Ltd. April 16th, 1936. (493916.)

10815. "Railway signalling systems." Westinghouse Brake & Signal Co., Ltd. June 10th, 1936. (493863.)

10818. "Excitation of synchronous motors." L. H. A. Carr, E. P. Hill and Metropolitan-Vickers Electrical Co., Ltd. April 15th, 1937. (493918.)

10842. "Electric welding." Linde Air Products Co. April 17th, 1936. (493866.)

10857. "Fine adjustment device for the brake magnet of an electricity meter. J. H. Wilson, and S. Johnson. April 16th, 1937. (493625.)

10907. "Television transmission with cathode-ray tubes." Radio Akt.-Ges. D. S. Loewe. April 16th, 1936. (493868.)

10915. "Automatic or semi-automatic telephone or like exchange systems." Standard Telephones and Cables, Ltd. (L. Kozma.) April 16th, 1937. (Addition to 440348.) (493870.)

10955. "Automatic switches for use in telephone or like systems." Automatic Telephone and Electric Co., Ltd., and R. N. Saxby. April 16th, 1937. (493874.)

10976. "Telephone systems." A. Graham and Co., Ltd., and C. H. Vaughan. April 17th, 1937. (493876.)

11038. "Cathode-ray tube." H. R. Lubcke. April 17th, 1937. (493882.)

11160. "Electrical driving equipment for rolling mills and the like." G. A. Juhlin, and Metropolitan-Vickers Electrical Co., Ltd. April 19th, 1937. (493629.)

11287. "Fluorescent materials and method of manufacturing the same." British Thomson-Houston Co., Ltd. April 22nd, 1936. (493722.)

12026. "Circuit arrangements for flashing a high-pressure metal vapour electric-discharge lamp." Siemens Electric Lamps and Supplies, Ltd., and J. N. Aldington. April 27th, 1937. (493634.)

12413. "Cathode-ray devices." British Thomson-Houston Co., Ltd., D. Gabor, and L. Rushforth. April 30th, 1937. (493790.)

12746. "Methods of and apparatus for interlaced scanning." S. L. Clothier, and H. C. Hogen-Camp. May 9th, 1936. (493885.)

12853. "Tuning devices for wireless receivers." General Electric Co., Ltd., and L. J. Stafford. May 5th, 1937. (493565.)

12932. "Cover plates employed with electric switches, plug-and-socket couplings, and like electrical fittings." R. Bain and N. Allday. May 6th, 1937. (493637.)

13159. "Electrical switches or circuit-breakers and contacts therefor." G. E. Whitehead, and Whitehead's Electrical Inventions, Ltd. May 7th, 1937. (493640.)

13795. "Thermally-operated electrical indicating instruments." S. Smith and Sons (Motor Accessories), Ltd., and V. J. S. Russell. May 18th, 1937. (493642.)

14247. "Adjusting the brake magnets of electricity meters." Switchgear and Meters, Ltd., and A. W. Angold. May 21st, 1937. (493645.)

15125. "Electrical switchgear." C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. May 31st, 1937. (493648.)

15503. "Electric switches of the push-button type." General Electric Co., Ltd., and A. Warrington. June 4th, 1937. (493649.)

15826. "Electric cooking ovens." Belling and Co., Ltd., and D. M. M. Brunton. June 8th, 1937. (493796.)

16158. "Protective control equipments for electrical apparatus." H. Hesketh, and Metropolitan-Vickers Electrical Co., Ltd. June 10th, 1937. (493797.)

16730. "Electric cartridge fuses." S. L. Lightfoot (trading as Standard Fuse Co.). June 16th, 1937. (493729.)

17386. "Electrical motors and methods of making the same." Borg-Warner Corporation. January 8th, 1937. (493569.)

17876. "Small synchronous electric motors." Chamberlain and Hookham, Ltd., S. James and R. P. Bossom. June 26th, 1937. (493654.)

19666. "Switching arrangements in selectors for use in automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. July 17th, 1936. (493656.)

20941. "Radio direction finding." Jaeger-Aviation. July 29th, 1936. (493574.)

23160. "Electric induction furnaces." G. D. L. Horsburgh, F. W. Tetley, and Swift, Levick and Sons, Ltd. August 24th, 1937. (493892.)

26443. "Impulse senders of the type used in telephone systems." General Electric Co., Ltd., and W. R. Rose. September 30th, 1937. (493663.)

27205. "Choking coils." Akt.-Ges. Brown, Boveri and Cie. October 7th, 1936. (493666.)

30126. "High-power high-tension electric condensers." Siemens-Schuckertwerke Akt.-Ges. November 3rd, 1936 (493583.)

31154. "Amplifying devices for use at telephone subscribers' stations." Standard Telephones and Cables, Ltd. November 20th, 1936. (493668.)

33147. "Electrical devices for indicating the presence of gases and suspended foreign matter therein." W. Jaeger. December 2nd, 1936. (493670.)

33553. "Thermionic amplifiers." Standard Telephones and Cables, Ltd. December 5th, 1936. (493671.)

35373. "High-frequency electrical signalling systems." C. Lorenz Akt.-Ges. December 21st, 1936. (493674.)

1938

223. "Electrical connector." Standard Telephones and Cables, Ltd. January 12th, 1937. (493676.)

1671. "Diversity radio transmission systems." Standard Telephones and Cables, Ltd. February 17th, 1937. (493679.)

3168. "Magnetic circuits for electrical apparatus." Soc. Savoisienne de Constructions Electriques. February 3rd, 1937. (493739.)

3409. "Electric sockets." British Thomson-Houston Co., Ltd. February 3rd, 1937. (493740.)

4097. "Method of joining metals together by electrical resistance welding." British Thomson-Houston Co., Ltd. February 9th, 1937. (Cognate application 4098/38.) (493741.)

6681. "Electrical snap-action switches." General Electric Co., Ltd., and W. J. D. Harrison. March 3rd, 1938. (493594.)

7643. "Electric lampholders." British Thomson-Houston Co., Ltd. March 12th, 1937. (493746.)

7647. "Keying arrangement for transmitters employed for direction-finding purposes." C. Lorenz Akt.-Ges. March 11th, 1937. (493683.)

8520. "Selective electric networks constituted by band-pass wave filters." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 22nd, 1937. (493823.)

8703. "Ceramic structures such as electric insulators and the like." British Thomson-Houston Co., Ltd. March 20th, 1937. (493599.)

8922. "High-voltage bushings." British Thomson-Houston Co., Ltd. March 23rd, 1937. (493826.)

9216. "Conveyor roller for rolling-mill feed tables having individual electric drive." F. Krupp Grusonwerk Akt.-Ges. May 27th, 1937. (Cognate application 9217/38.) (493601.)

9220. "Braun tubes for television." P. S. Allam. (Schlesische Spiegelglas-Manufactur C. Tielsch Ges.). March 25th, 1938. (493602.)

9895. "Alternating-current generators." British Thomson-Houston Co., Ltd. April 1st, 1937. (493827.)

10091. "Electro-optical system." Standard Telephones & Cables, Ltd. June 4th, 1937. (493687.)

10170. "Method and device for examining multi-phase systems." C. H. F. Muller Akt.-Ges. April 5th, 1937. (493603.)

10194. "Devices for cooling mercury-vapour discharge apparatus of glass." Jenaer Glaswerk Schott & Gen. April 9th, 1937. (493750.)

10559. "Electric resistance elements." G. C. Gaut, B. F. Huggins, D. Swaddle, H. V. G. Stubbs and Plessey Co., Ltd. April 6th, 1938. (Addition to 460895.) (493607.)

10799. "Electron-discharge devices." Fernseh Akt.-Ges. April 3th, 1937. (493751.)

11204. "Electric signalling systems." Siemens & Halske Akt.-Ges. April 12th, 1937. (Cognate application 11205/38.) (493903.)

13601. "Adjusting mechanism for the quadrature loops of electricity meters." Switchgear & Meters, Ltd., and A. W. Angold. May 21st, 1937. (Divided out of 493645.) (493689.)

16414. "Devices comprising an electric high-pressure metal-vapour discharge tube." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 4th, 1937. (Addition to 477747.) (493831.)

20747. "Machines for covering electric cables." H. G. C. Fairweather (Compagnie Générale d'Electricité). July 13th, 1938. (493385.)

25412. "Systems controlling the sequential actuation of electrically operated soot-blowers." British Thomson-Houston Co., Ltd., S. N. Bourne and H. F. Jefferson. March 8th, 1937. (Divided out of 491915.) (493905.)

Contract Information

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Aberdeen.—November 15th. County Council. Electrical work at Hatton of Cruden housing estate. County Clerk, 22, Union Terrace.

November 15th. Education Committee. Electrical work at Torphins School. Director of Education, County Buildings, 22, Union Terrace.

Argentina.—BUENOS AIRES.—November 21st. National Sanitation Works Department. 1,340 electricity meters. (T.Y. 27794/38.)*

Australia.—BRISBANE.—November 22nd. Posts and Telegraphs Department. Lead-covered cable. (T. 28018/38.)*

GLADSTONE.—November 23rd. Electricity Authority. One 200-kVA and one 100-kVA alternator. (T. 28027/38.)*

MELBOURNE.—December 6th. Posts and Telegraphs Department. Enamel insulated, braided cable. (T. 28566/38.)*

Birkenhead.—November 15th. Electricity Department. Extra-high-voltage and low-voltage cable and electricity meters for twelve months. (October 28th.)

Birmingham.—November 23rd. Electric Supply Department. All-insulated switch-fuses for twelve months. (October 28th.)

November 15th. Borough Council. Electrical installation at the Derby Bath. (October 28th.)

Bury.—November 24th. Education Committee. Electrical installation at the new technical college. (November 4th.)

Droxford.—November 14th. R.D.C. One vertical borehole centrifugal pump and electric motor, with all necessary accessories, for the waterworks pumping station, West Meon, Hampshire. Lemon & Blizard, Lansdowne House, Castle Lane, Southampton (deposit £3 3s.).

Fife.—November 15th. County Council. Electrical and heating installations at Viewforth School, Kirkcaldy. James Gentles & Son, Central Chambers, High Street, Kirkcaldy (deposit £1 1s.).

Grimsby.—November 11th. Electricity Department. P.i., lead-covered, hessian taped, armoured cables for twelve months. (November 4th.)

Hull.—November 14th. Town Council. Trolley-bus overhead equipment, including tubular steel poles, trolley wire and overhead fittings. General manager, Transport Offices, Ferensway.

Ilford.—November 12th. Electricity Department. Eight 500-kVA transformers. (November 4th.)

London.—BETHNAL GREEN.—November 18th. Electricity Undertaking. One 750-kVA transformer. (October 28th.)

ST. MARYLEBONE.—November 22nd. Borough Council. Power and lighting indoor-type transformer groups and high- and low-voltage switchgear for indoor transformer stations for twelve months. (See this issue.)

HORNSEY.—November 26th. Electricity Department. Installation of electrode boiler central heating plant at the electricity showrooms proposed to be erected in the Broadway, Crouch End. (See this issue.)

Louth.—November 21st. Electricity Department. P.i., lead-covered, low-voltage cables. (October 28th.)

Maidstone.—November 26th. Kent County Council. Electrical installation in connection with third scheme of development at Leybourne Grange Colony. County architect, Springfield (deposit of £5 5s.).

Morley.—November 22nd. Housing Committee. Electrical work at fifty-four houses and eight flats on the Hill Top estate, West Ardsley. E. V. Finnigan, Town Clerk, Town Hall (deposit £2 2s.).

Musselburgh.—November 14th. Town Council. Electrical work at eighty-nine houses. Town Clerk.

New Zealand.—WELLINGTON.—February 14th, 1939. Public Works Department. Supervisory or remote-control equipment, semi-automatic and protective equipment, switchgear and accessories. (T.Y. 27946/38.)* Auxiliary generator and exciter sets, voltage-regulating equipment and accessories. (T.Y. 27947/38.)*

February 14th. Remote control, supervisory and recording equipment. (T. 28512/38.)*

December 15th. Posts and Telegraph Department. Twelve 5,000-V DC fixed mica condensers. (T. 28503/1938.)*

January 6th. 15,000 telephones. (T. 28497/38.)*

January 9th. Two motor-generator sets. (T Y. 27818/1938.)*

January 24th. Cadmium copper wire. (T. 28506/38.)*

January 25th. One mile of star quad cable. (T. 28498/38.)*

Northallerton.—November 16th. North Riding Education Committee. Installation of electric lighting at the new senior school, Windsor Road, Redcar. Secretary, Education Offices, County Hall.

Portsmouth.—November 14th. Electricity Undertaking. One 50-kVA voltage regulator and three 500-kVA transformers. (November 4th.)

Preston.—November 25th. Electrical installation at a new school at Brierfield. S. Wilkinson, architect, Lancashire County Council Offices (deposit £2 2s.).

Rochdale.—November 22nd. Electricity Department. AC 5-A and 25-A quarterly and prepayment meters for twelve months. (October 28th.)

South Africa.—PORT ELIZABETH.—November 24th. City Municipality. Two miles of low-voltage cables and quantities of 250-V lamps. (T.Y. 28130/38.)*

JOHANNESBURG.—November 17th. Electricity Department. 20,000-V 0.25 sq. in. three-core screened cable, pilot cable, joints and auxiliary appliances. (T.Y. 28146/1938.)*

CAPE TOWN.—December 14th. Electricity Department. Low-voltage pole mounting fuse holders and high-rupturing-capacity fuses. (T.Y. 27985/38.)*

PRETORIA.—December 1st. Union Tender and Supplies Board. 1,000,000 insulated, fibre head, 1-in. nails. (T.Y. 27999/38.)*

December 8th. Switchboards. (T.Y. 28272/38.)*

Wakefield.—November 21st. West Riding County Council. Installation of electric lighting at Bentley Toll Bar school. Clerk of the County Council, County Hall.

West Ham.—November 28th. Electricity Department. Coal for the generating station for twelve months. (See this issue.)

Orders Placed

Birkenhead.—Electricity Committee. Accepted. Electrical installations at twenty-eight houses (£130).—Park Electrical Co.

Brighton.—Electricity Committee. Recommended. Boiler units and ancillary apparatus (£190,000).—Babcock and Wilcox.

Dover.—Town Council. Accepted. Erection of a 6,600-V kiosk sub-station at Elms Vale Road (£217).—G.E.C.

Dumfries.—Accepted. The Grove Hospital: Electrical installation.—Anderson & Munro. Electric lift.—Etchells, Congdon & Muir.

London.—L.C.C. Housing and Public Health Committee. Accepted. Wiring and fittings for electric lighting, &c.: 806 houses and flats at Becontree (£6,070).—Holliday & Son (Electrical). 804 houses and flats at Downham (£6,092).—E. & C. Champion. Dorset Road and Newburn Street areas, Lambeth (£3,375).—Holliday & Son (Electrical). Blocks of dwellings on the Tulse Hill site, Lambeth (£6,021).—Holliday & Son (Electrical).

Wiring and fittings for electric lighting, &c., in blocks of dwellings at Wellington estate and a block of dwellings in the Tent Street area, Bethnal Green.

	£		£
Pemberton and Sturgess (Great Britain). Accepted	**2,156**	H. Shadwell	2,237
Newman and Watson	2,197	City Electrical Co.	2,263
Archibald Meckhonik	2,200	Jacob, White & Co.	2,267
		Buchanan and Curwen	2,390

Wiring and fittings for electric lighting, &c., in blocks of dwellings at the White City site, Hammersmith:

	£		£
Archibald Meckhonik. Accepted	**18,499**	Pemberton and Sturgess (Great Britain)	20,487
Samuel Reed & Sons	19,124	Electrical Installations ...	20,731
Read and Partners	19,576	Jacob, White & Co.	21,006
Newman and Watson	19,602	Francis Polden & Co.	21,085
Coleby & Co.	19,724	Alexander Hawkins & Sons ...	24,775
Buchanan and Curwen ...	19,920		
W. H. Gaze & Sons	20,182		

Provision of an electric bed lift in the new maternity block at Hackney Hospital:

	£		£
Express Lift Co. Accepted ...	**969**	Pickerings	1,108
Glasgow Engineers	979	Etchells, Congdon and Muir ...	1,110
Aldous and Campbell	1,015	Marryat and Scott	1,199
Evans Lifts	1,055	J. and E. Hall	1,200
Bennie Lifts	1,077	Waygood-Otis	1,389

Wiring and fittings at Fossdene Road School:

	£		£
J. L. Shadwell. Accepted ...	**882**	Pemberton and Sturgess (Great Britain)	1,140
Newman and Watson	960	Francis Polden & Co.	1,147
Springvale Electrical Co. ...	1,002	F. H. Wheeler & Co.	1,154
J. H. Plant	1,017	Ilford Electrical Co.	1,167
H. J. Cash & Co.	1,084		
Jacob White & Co.	1,135		

Wiring and fittings at Nelson School:

	£		£
J. L. Shadwell. Accepted ...	**997**	Berkeley Electrical Engineering Co.	1,247
G. A. Weston	1,114	City Electrical Co.	1,256
S. Reed & Sons	1,161	Jacob White & Co.	1,257
Read and Partners	1,198	Springvale Electrical Co. ...	1,289
E. W. Merredew	1,219		

Notts.—Health Committee. Accepted. Electrical repairs at hospital (£452).—Retford Electrical Services. Bed lift at Ransom Sanatorium (£378).—Evans Lifts. Boiler and generating plant (£19,100).—Brightside Foundry and Engineering Co.

Education Committee. Accepted. Electrical installation at Hopwell Hall school (£140).—F. Lamb. West Bridgford secondary school: Electric dish washer (£138).—Hobart Manufacturing Co. Radio equipment (£126).—G.E.C. Refrigerator and irons (£103) and stage lighting (£310).—F. Lamb.

Plymouth.—Electricity Committee. Accepted. Two boilers with buildings and auxiliary equipment at Prince Rock power station (£105,216).—Yarrow & Co. 33,000-V metal-clad switchgear (£16,161).—Met.-Vick. Electrical Co.

Sheffield.—Electricity Committee. Accepted. Sub-station switchgear (£6,341).—A. Reyrolle & Co.

Southall.—Middlesex County Council. Accepted. Electrical installation at county school (£1,379).—F. Troy & Co.

Stirling.—County Council. Accepted. Electrical work at thirty-two houses at Milton of Campsie.—E. Mason, Denny.

Sunderland.—Town Council. Accepted in place of tender withdrawn. Installation of electricity at nurses' hostel (£1,637). —F. Reid, Ferens & Co.

Accepted. Electrical equipment for sub-stations: Two transformers (£350).—Bonar & Long. Instrument panel (£40).—Johnson & Phillips. Switchgear (£147).—Henley's. Extra-high-voltage switchgear (£2,155).—A. Reyrolle & Co.

Whitby.—U.D.C. Accepted. Electrical work at the new isolation hospital.—Barratt Bros.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Ice rink (£50,000); J. & G. Collie, 1, East Crailestones Street.

Altrincham.—Cinema, Park Road, Timperley, for W. G. Smith, "Devonia," Oaklands Drive, Sale, Cheshire; Drury and Gomersall, architects, Imperial Buildings, 11, Oxford Road, Manchester.

Berwick.—Fire station, for T.C.; borough engineer. Extensions to high school (£7,593); J. H. Pierce.

Billingham-on-Tees.—Development of land near Billingham Station, for U.D.C.; J. J. Hill, surveyor.

Birkenhead.—Cinema, Argyle Street; Savoy Co.

Blackpool.—Block of shops and flats, Waterloo Road, South Shore; John Gregson & Son, contractors, 3, Newhouse Road, Marton.

Blyth.—Houses (76), Plessey Road, for the T.C.; Nicholson and Hush, builders, Croft Road.

Bournemouth.—Development of Longbarrow estate, Castle Lane; Fox & Son.

Brighton.—Flats, Manor Farm estate, and houses; borough engineer.

Bromsgrove.—Houses (35) at the junction of Alcester Road and Middle Lane, Wythall; E. J. Vale, High Street, Warstock, Birmingham, 14.

Burntisland.—Cinema, High Street, for Burntisland Associated Pictures, Ltd.

Cannock.—Houses (18) and bungalows, Penkridge; Swingwood, Shaw and Lymer, Rugeley Road, Chase Terrace, Staffordshire.

Cleckheaton.—School, Headlands Road, Liversedge (£6,000); R. Castle & Sons, architects, Midland Bank Chambers, Cleckheaton.

Cockermouth.—Houses (50), Windmill estate; U.D.C. surveyor.

Coventry.—Houses (32), Arundel Road, Keviliok Street, Meschines Road and The Chesils, for J. Whitaker, 11, Lollard Croft; G. A. Steane, architect, 5, Queen Victoria Road. Houses, Ashington Grove, for Bamford & Co., Millstone Lane, Leicester, and Kingsbury Road, for Wonder Houses, Ltd., Bevington Crescent; H. Whiteman & Son, architect, 4, Queen Victoria Road, Coventry.

Darlington.—Alterations to cinema, Northgate, for T. Glaister; Lawson and Boddy, builders, Polam Hill estate. Alterations and extensions to the fire station (£3,500); E. Minors, borough engineer.

Dewsbury.—Houses (59), Heathfield Road and Ravensthorpe Road; J. Tierney, builder, Danesfort, Boothroyd Lane.

Droitwich.—Houses (70), Garden estate; borough engineer.

Dudley.—Houses (12), Buffery Lane; H. Smart.

Dunoon.—Cinema, Argyll Street; James Houston, architect, Kilbirnie, Ayrshire.

Durham.—Hotel, Farewell Hall, for Calders, Ltd. (£4,000); Carr Brothers, builders, Farewell Hall estate.

Eccles.—Houses (10), Stanley Road; J. Grayson.

Eston.—Houses (122), South Bank (£40,000); U.D.C. surveyor.

Eyemouth (BERWICKSHIRE).—Conversion of old police station into a laundry; Sir Christopher Furness, Bart.

Ferryhill (Co. DURHAM).—Houses (10), Cleves Cross; J. and S. Bernstein, builders, Ferryhill.

Hanley.—Site development, near Windermere Road; Salt & Trice.

Hetton (Co. DURHAM).—Houses (86), East Rainton, for the U.D.C.; F. W. Goodyear and Co., Ltd., builders, 60, Claypath, Durham.

Hull.—Fracture clinic, Brook Street, for the Hull Royal Infirmary Board of Management; George Houlton & Sons, Ltd., contractors, Baker Street.

Ilford.—Houses (20) and flats, near Craven Gardens; E. Meredith, 6, Victoria House, High Road, Goodmayes.

Inverness.—Hotel, Bogbain, for Lochness Hotels, Ltd.

Irvine (AYRSHIRE).—General store, offices, and hall (£16,000), for the Irvine and Fullarton Co-operative Society; Mr. Vallance, architect, Irvine.

Kettering.—Extensions to isolation hospital, Rockingham Road; Blackwell and Storry, Gold Street Chambers.

Kirkintilloch.—Reconstruction of moulding shop and additions to works, for Forth and Clyde Steel Works; the manager.

Lancashire.—Staff accommodation at various hospitals (£30,000); county architect. Schools, Aston-in-Makerfield (£68,300), Upholland (£68,300), and Golborne (£42,880), for the County E.C. School, Tottington (£22,657), for the E.C.; Adshead, Topham and Adshead, architects, 14, Ridgefield, Manchester. School, Turton, for the E.C.; Richard Mosley, contractor, Charnock Street, Bolton. Enlargement of grammar school, Middleton (£17,387), for the County E.C.

Largs.—Cinema, Irvine Road, for J. Hamilton, 324, Albert Drive, Glasgow.

Liverpool.—Factory, Cheapside, for Kley Bros., Ltd., 68, Byrom Street; Lloyd & Cross, Ltd., contractors, 57, Hamilton Square, Birkenhead.

London.—(HACKNEY).—Dwellings, Pembury estate; Rowley Bros., Ltd., Tower Works, Dunloe Avenue, N.17. (STEPNEY).—Dwellings, Market site; borough engineer.

Manchester.—Houses, Meade Hill Road, Mosslee Avenue and Newborough Avenue, Crumpsall; J. G. Whitelegg, Sheepfott Lane estate, Heaton Park.

Market Harborough.—Extensions to factory, Church Gate; R. & W. H. Symington & Co., Ltd.

Middlesbrough.—Houses, Park Road South; O. W. Dean, builder, 46, Roman Road, Linthorpe.

Mirfield.—Houses (44), Stocks Bank Road; P. Womersley, Royal Joinery Works, Huddersfield Road.

Morpeth.—Houses (154), Widdrington estate; R.D.C. surveyor.

Newburn-on-Tyne.—Fire station (£9,600); J. W. Weatherley, surveyor.

Newcastle-on-Tyne.—Houses, Bosworth Gardens; W. K. Waite, builder, Jesmond-on-Tyne. Houses (18), Heathfield Road; E. Jeffcock, builder, Walbottle Road, Newburn-on-Tyne. Flats (40), Hill Street, for the City Council; city architect. Conversion of old newspaper offices, Gallowgate, into garage and showroom for Auto-Garages (Northern), Ltd.; J. Walton Taylor and Son, architects, Union Buildings, St. John Street, Newcastle-on-Tyne.

Northallerton.—Council offices (£3,500); U.D.C. surveyor.

Nottinghamshire.—School, Selston (£33,570), for the County E.C.

Oundle.—Houses, Clapthorn, Kingscliffe and Ringstead; R.D.C. surveyor.

Portsmouth.—Houses (116), Farlington; city engineer.

Prudhoe-on-Tyne.—Houses (36), Low Prudhoe, for the U.D.C.; W. Charlton and Son, builders, Paygate, Crawcrook.

Redditch.—Factory, for Harris & Walford, Ltd., Park Road.

Saddleworth.—Houses and bungalows, Dobcross, for U.D.C.; R. S. Ainscough, contractor, The Mount, Rumbles Lane, Delph, Oldham.

Salford.—School, Lancaster Road, Pendleton; C. H. Godfrey & Sons, contractors, Bowling Road, Gorton, Manchester, 18.

Scunthorpe.—Showrooms and library at the junction of High Street and Oswald Road, for the T.C.; T. C. Howitt, architect, Exchange Buildings East, Nottingham.

Seaton Valley.—Extensions to Shiremoor school (£16,747); Gibson Bros.

Sheffield.—Factory for Welding Rods, Ltd., Greenland Road, Attercliffe.

Staveley.—Houses (88), Norbriggs estate; U.D.C. surveyor.

Sunderland.—Houses (28), West House Park estate, for the T.C.; Bell Brothers, builders, West House, Newcastle Road. Café and ice-cream bar, High Street West, for Notarianni Bros.; G. E. Matkin, architect, Barclay's Bank Chambers. Tuberculosis block at the Municipal Hospital, for the T.C. (£2,500); borough engineer. Alterations to the Empire Theatre; W. and T. R. Milburn, architects, 17, Fawcett Street.

Surrey.—Mental hospital, Merrist Wood estate, Worpleston, for the Surrey C.C. Schools, Horley, Oxted and Merton, for the County E.C.

Torquay.—Houses (25), Barton Road; P. G. Cavanna.

Tynemouth.—Hotel for McEwan and Co., Ltd.; Hastie D. Burton, Ltd., builders, King Street, North Shields.

Wednesbury.—Works, Lodge Holes, for Henry Hope & Sons, Ltd., Halford, Smethwick; George Webb & Sons, Ltd., contractors, Soho Hill, Birmingham, 19.

Weymouth.—Houses (28), Beaumont Avenue; A. A. Hayward.

Wigton.—Houses (59), Noble Temple Field, Aspatria, for the Wigton R.D.C.; North-Eastern Housing Association, Metro-Vick House, Westmorland Road, Newcastle-on-Tyne.

Wimbledon.—School of Art (£31,972); W. F. Blay, Ltd., 6a, Spital Street, Dartford.

Wombwell.—Houses (74), Jump estate; U.D.C. surveyor.

Woodmansterne.—School (£13,291); Uden & Co., Ltd.

Worcestershire.—School, Upton-on-Severn, for the County E.C.; A. V. Rowe, county architect.

Yeovil.—Houses (60), St. Michael's estate; borough engineer.

Status of the Engineer

A DISCUSSION on the status, qualifications and remuneration of engineers took place at the JUNIOR INSTITUTION OF ENGINEERS in London on October 28th.

In his short opening paper Dr. H. Chatley pointed out that the status of the engineer was of importance because eventually the world must largely be controlled by technicians. Skilled ability to direct engineering operations was the real test. Every possible opportunity should be sought to inform the public of the enormous economic and welfare value of engineering. Erroneous statements concerning engineers and the very frequent adulation of figureheads should be challenged. Every occasion on which works were described without appreciative reference to the engineer responsible should be made the subject of protest in the most vigorous manner possible. Retired engineers and those with some spare time should participate in local government politics. Engineering institutions should demand to be represented on public commissions which in any way whatsoever involved technical problems.

They should take up all cases in which inadequate salaries were offered and discourage members from accepting such posts, at the same time impressing upon the parties concerned the economic responsibility of the engineer. Scales of standard minimum pay for engineers should be compiled and renewed from time to time, and endeavours made to insist upon their observance. Efforts should also be made to secure a large proportion of public honours for engineers. The value of technical education as a training for public life and service should be impressed upon the community. Practical economics should be more emphasised in engineering training.